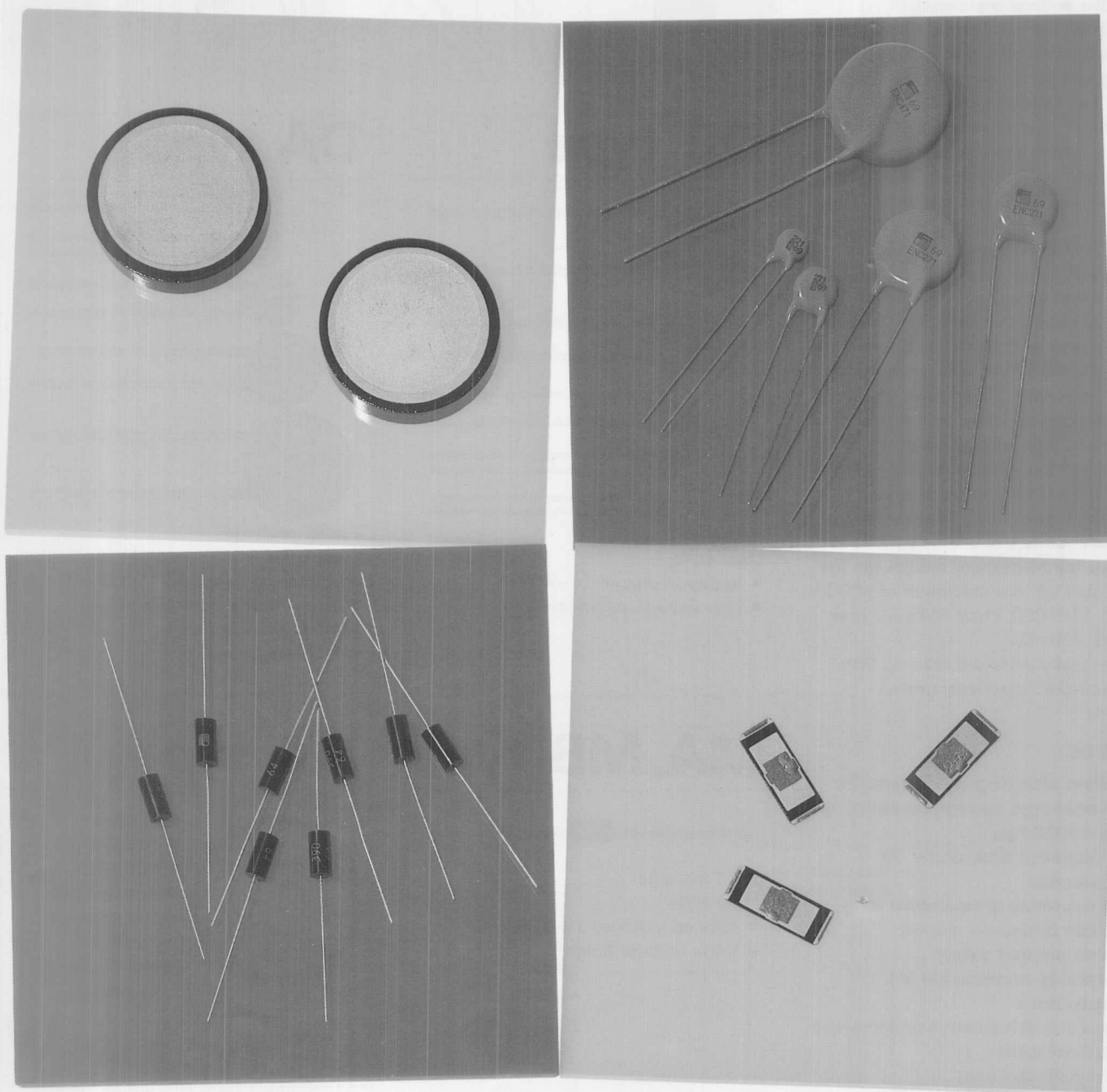


FUJI Ceramic Surge Absorbers

New ENC Series Z-TRAP



Metal Oxide Varistors for Transient Voltage Protection

FUJI Z-TRAP ENC SERIES

Transient Suppressors

General description

FUJI's new line of ceramic surge absorbers are designed to protect low voltage electronic devices such as semiconductors from the effects of destructive voltage transients. The Z-TRAP ENC series are widely used in applications where protection from lightning and switching surges is required, such as TV, broadcasting and communication equipment, and similar situations where there is danger of overvoltages or lightning damaging ICs, silicon diodes, thyristors and other devices.

FUJI Z-TRAP ENC series are gapless ceramic surge absorbers of a new type using a metal oxide.

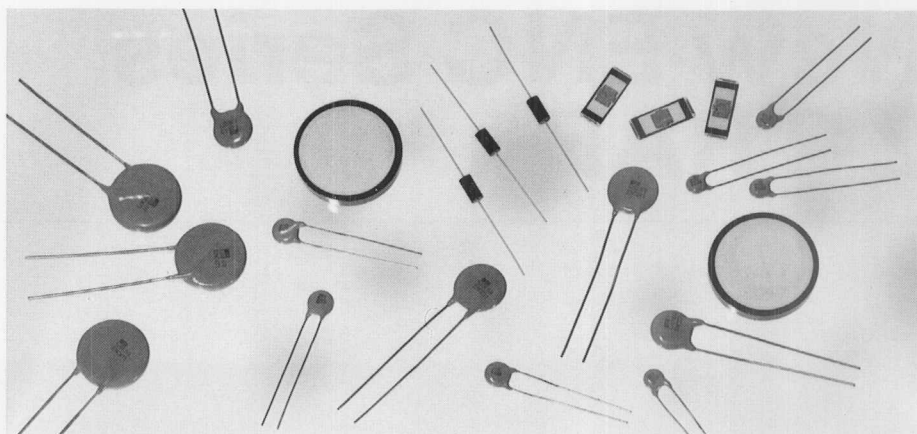
They have excellent non-linear characteristics and their use gives a high degree of reliability to voltage sensitive circuit components. They have excellent clamping characteristics, and when subjected to high energy transient currents their impedance rapidly changes from a high standby value to a low conducting value which keeps voltages within safe limits.

Discharge transient peak current ratings are available up to a maximum of 4000A between 11–1000 Volts RMS AC and 14–1465 Volts DC.

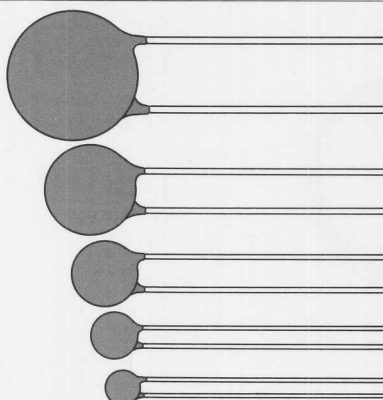
They are easily installed, take up little space, and are attractively priced.

Features

- Excellent clamping characteristics
- High discharge current capability—up to 4000Amps
- Fast response time—under 50 nanoseconds
- Wide operating temperature range
- Eliminate follow-on current
- Improve product safety
- Remarkably symmetrical V-I characteristics
- Protect circuit insulation and improve system reliability
- Low installation cost
- UL recognized (UL1414)



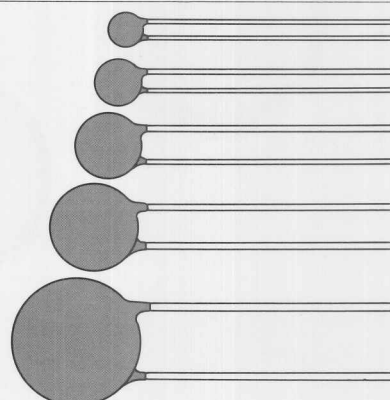
DB type



Radial package
Lead style

- Applied voltage: 11–40VAC
- Low voltage operation

DA type



Radial package
Lead style

- Applied voltage: 50–1000VAC
- Line voltage operation
- Wide voltage range
- UL Recognized

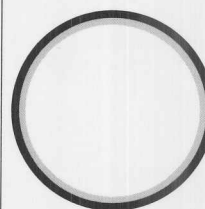
MA, MB type



Axial package
Lead style

- Applied voltage: 17–286VAC
- Wide voltage range

AA type **NEW**



Disk chip

- Applied voltage: 600VAC
- Arrester disk
- High energy capability
- No follow-on current

LA type **NEW**

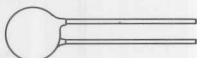
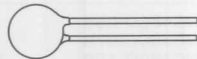

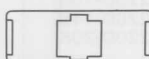



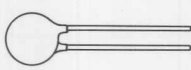
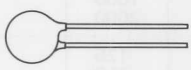
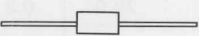
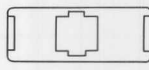

Lead less style
Surface mount

- Applied voltage: 117.4VAC
- 2-varistor, 3-contact

Due to our continuing program of product improvement, specifications are subject to change without notice.

Selection guide

Peak current (Amps)	Energy (Joules)	Max. steady state applied voltage							Packages
		Volts AC r.m.s		Volts DC					
		11 17	40 50	117.4	286			1000	
		14 17	56 65	108	380	600		1465	
125 to 2000	0.3 to 40	<div>DB type (Radial package)</div>							
250 to 4000	1.7 to 400	<div>DA type (Radial package)</div>							
25 to 100	0.22 to 4	<div>MA & MB type (Axial package)</div>							
25	7	<div>LA type (Lead less dual package)</div>							
40k	600	<div>AA type (Disk chip)</div>							

Type					
	DB type L.V. Radial lead	DA type H.V. Radial lead	MA & MB type MA: H.V. axial lead MB: L.V. axial lead	LA type Dual, surface mount	AA type Disk chip
Operating ambient temperature	-40 to +85°C	-40 to +85°C	-40 to +85°C	-40 to +85°C	-20 to +40°C
Storage temperature	-40 to 125°C	-40 to 125°C	-40 to 100°C	-40 to 100°C	-20 to 75°C
Voltage temperature coefficient	-0.05%/°C	-0.05%/°C	-0.05%/°C	-0.05%/°C	-0.1%/°C
Insulation resistance (at 500V)	Over 1000MΩ	Over 1000MΩ	Over 1000MΩ	N.A.	N.A.
Hipot encapsulation (for 1 min.)	1500V AC	1500V AC	1000V AC	—	—

Type number nomenclature

ENC 271 D - 14 A □

Basic type
ENC: ENC series

Varistor nominal voltage

180: 18V 820: 82V 271: 270V 751: 750V
220: 22V 101: 100V 361: 360V 781: 780V
270: 27V 121: 120V 391: 390V 821: 820V
330: 33V 151: 150V 431: 430V 911: 910V
390: 39V 201: 200V 461: 460V 102: 1000V
470: 47V 221: 220V 471: 470V 112: 1100V
560: 56V 241: 240V 621: 620V 182: 1800V
680: 68V 251: 250V 681: 680V

Package

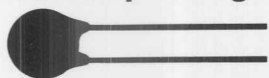
A: Disk chip
D: Radial package
L: Lead less dual package (surface mounting)
M: Axial package

No. of elements
No mark: Single element
2 : Dual elements

Classification
A: High voltage
B: Low voltage

Chip element size (Dia.)
03: φ 3mm 10: φ 10mm
05: φ 5mm 14: φ 14mm
07: φ 7mm 20: φ 20mm
09: φ 9mm 32: φ 32mm

ENC Series Radial package



DB type: 11 — 40V AC

Ratings and characteristics table

Device type	Chip element size	Maximum ratings					Characteristics					
		Applied voltage ①		Transient			Nominal varistor ④ peak voltage		Max. clamping voltage ⑤ @ test current (8/20μs)		Typical capacitance	
		RMS 50/60Hz (25°C)	DC (25°C)	Energy ②	Average power dissipation	Peak current ③ (8/20μs)						
	Dia. [mm]	Vacm [Volts]	Vdcm [Volts]	Wtm [Joules]	Ptam [Watts]	I _{tm} [Amps]	V _{nom} [Volts]	Tolerance		V _c [Volts]	I _p [Amps]	f = 1kHz [pF]
ENC180D-05B	5	11	14	0.3	0.01	125	18	16	20	40	1	1700
ENC180D-07B	7			0.8	0.02	250				36	2.5	3500
ENC180D-10B	10			1.5	0.05	500				36	5	7000
ENC180D-14B	14			3.5	0.1	1000				36	10	14000
ENC180D-20B	20			10.0	0.2	2000				36	20	28000
ENC220D-05B	5	14	18	0.4	0.01	125	22	20	24	48	1	1200
ENC220D-07B	7			0.9	0.02	250				43	2.5	2500
ENC220D-10B	10			2.0	0.05	500				43	5	5000
ENC220D-14B	14			4.0	0.1	1000				43	10	11000
ENC220D-20B	20			13.0	0.2	2000				43	20	22000
ENC270D-05B	5	17	22	0.5	0.01	125	27	24	30	60	1	1100
ENC270D-07B	7			1.0	0.02	250				53	2.5	2200
ENC270D-10B	10			2.5	0.05	500				53	5	4500
ENC270D-14B	14			5.0	0.1	1000				53	10	9000
ENC270D-20B	20			15.0	0.2	2000				53	20	18000
ENC330D-05B	5	20	26	0.6	0.01	125	33	30	36	73	1	1000
ENC330D-07B	7			1.2	0.02	250				65	2.5	2000
ENC330D-10B	10			3.0	0.05	500				65	5	4000
ENC330D-14B	14			6.0	0.1	1000				65	10	8000
ENC330D-20B	20			20.0	0.2	2000				65	20	16000
ENC390D-05B	5	25	31	0.8	0.01	125	39	35	43	86	1	800
ENC390D-07B	7			1.5	0.02	250				77	2.5	1600
ENC390D-10B	10			3.5	0.05	500				77	5	3200
ENC390D-14B	14			7.0	0.1	1000				77	10	6500
ENC390D-20B	20			24.0	0.2	2000				77	20	13000
ENC470D-05B	5	30	38	1.0	0.01	125	47	42	52	104	1	700
ENC470D-07B	7			1.8	0.02	250				93	2.5	1400
ENC470D-10B	10			4.5	0.05	500				93	5	2800
ENC470D-14B	14			8.5	0.1	1000				93	10	5500
ENC470D-20B	20			30.0	0.2	2000				93	20	11000
ENC560D-05B	5	35	45	1.0	0.01	125	56	50	62	123	1	600
ENC560D-07B	7			2.2	0.02	250				110	2.5	1300
ENC560D-10B	10			5.5	0.05	500				110	5	2500
ENC560D-14B	14			10.0	0.1	1000				110	10	5000
ENC560D-20B	20			35.0	0.2	2000				110	20	10000
ENC680D-05B	5	40	56	1.2	0.01	125	68	61	75	150	1	500
ENC680D-07B	7			2.5	0.02	250				135	2.5	1000
ENC680D-10B	10			6.5	0.05	500				135	5	2000
ENC680D-14B	14			12.0	0.1	1000				135	10	4000
ENC680D-20B	20			40.0	0.2	2000				135	20	8000

Notes:

① The waveform of the maximum DC applied voltage is flat. When a ripple voltage as from a rectifier source is supplied make sure that the peak voltage is kept under the V_{dcm}.

An AC applied voltage (50/60Hz) forms a sine waveshape.

When the distortion in the waveform is extensive make sure that the peak voltage is less than $\sqrt{2}$ times the Vacm.

② Energy: W_{tm}

Transient energy ratings are given in the W_{tm} column of the specifications in Joules (watt-second).

The rating is the maximum allowable energy for a single impulse of 2ms square-waveform current with continuous voltage applied. Energy ratings are based on a shift of V_{nom} of less than $\pm 10\%$ of initial value.

③ Transient peak current (I_{tm})

The peak current rating, I_{tm}, of varistor is based on an 8/20μs test impulse waveshapes.

This peak current is the maximum peak current in which the nominal varistor voltage shift does not exceed $\pm 10\%$ when the test impulse is applied twice at 5 minutes intervals.

④ Nominal varistor voltage: V_{nom}

Indicates the varistor terminal voltage measured with a 1mA DC applied. — 0.1mA DC in the case of the 05A and 05B series.

⑤ Maximum clamping voltage: V_c

Indicates the peak terminal voltage measured with an 8/20μs impulse current applied.

● Operating ambient temperature: -40°C to +85°C

● Storage temperature: -40°C to +125°C

* UL recognized (UL 1414)

FUJI Z-TRAP varistors have been tested by Underwriter's Laboratories, Inc. UL File No. E66188.

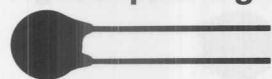


DA type: 50 – 230V AC

Ratings and characteristics table

Device type	Chip element size	Maximum ratings					Characteristics					
		Applied voltage ①		Transient			Nominal varistor ④ peak voltage			Max. clamping ⑤ voltage @ test current (8/20μs)		Typical capaci- tance
		RMS 50/60Hz (25°C)	DC (25°C)	Energy ②	Average power dissipa- tion	Peak ③ current (8/20μs)						
	Dia. [mm]	Vacm [Volts]	Vdcm [Volts]	Wtm [Joules]	Ptam [Watts]	Itm [Amps]	Vnom [Volts]	Tolerance		Vc [Volts]	Ip [Amps]	f=1kHz [pF]
ENC820D-05A ENC820D-07A ENC820D-10A ENC820D-14A ENC820D-20A	5 7 10 14 20	50	65	1.7 3.5 8.0 14.0 27.0	0.1 0.25 0.4 0.6 1.0	250 600 1250 2500 4000	82	74	90	145 135 135 135 135	5 10 25 50 100	400 800 1500 3000 6000
ENC101D-05A ENC101D-07A ENC101D-10A ENC101D-14A ENC101D-20A	5 7 10 14 20	60	85	2.0 4.0 10.0 18.0 30.0	0.1 0.25 0.4 0.6 1.0	250 600 1250 2500 4000	100	90	110	175 165 165 165 165	5 10 25 50 100	350 700 1500 3000 6000
ENC121D-05A ENC121D-07A ENC121D-10A ENC121D-14A ENC121D-20A	5 7 10 14 20	75	100	2.5 5.0 12.0 20.0 40.0	0.1 0.25 0.4 0.6 1.0	250 600 1250 2500 4000	120	108	132	210 200 200 200 200	5 10 25 50 100	350 700 1300 2600 5200
ENC151D-05A ENC151D-07A ENC151D-10A ENC151D-14A ENC151D-20A	5 7 10 14 20	95	125	3.0 6.0 16.0 25.0 50.0	0.1 0.25 0.4 0.6 1.0	250 600 1250 2500 4000	150	135	165	260 250 250 250 250	5 10 25 50 100	250 500 1000 2000 4000
ENC201D-05A * ENC201D-07A * ENC201D-10A * ENC201D-14A * ENC201D-20A *	5 7 10 14 20	130	170	4.0 10.0 20.0 35.0 70.0	0.1 0.25 0.4 0.6 1.0	250 600 1250 2500 4000	200	185	225	355 340 340 340 340	5 10 25 50 100	200 400 800 1600 3200
ENC221D-05A * ENC221D-07A * ENC221D-10A * ENC221D-14A * ENC221D-20A *	5 7 10 14 20	140	180	4.5 10.0 23.0 40.0 75.0	0.1 0.25 0.4 0.6 1.0	250 600 1250 2500 4000	220	198	242	380 360 360 360 360	5 10 25 50 100	170 350 700 1400 2800
ENC241D-05A * ENC241D-07A * ENC241D-10A * ENC241D-14A * ENC241D-20A *	5 7 10 14 20	150	200	5.0 10.0 25.0 40.0 80.0	0.1 0.25 0.4 0.6 1.0	250 600 1250 2500 4000	240	216	264	415 395 395 395 395	5 10 25 50 100	170 350 700 1300 2600
ENC271D-05A * ENC271D-07A * ENC271D-10A * ENC271D-14A * ENC271D-20A *	5 7 10 14 20	175	225	6.0 12.0 30.0 50.0 90.0	0.1 0.25 0.4 0.6 1.0	250 600 1250 2500 4000	270	247	303	475 455 455 455 455	5 10 25 50 100	150 300 600 1200 2400
ENC361D-05A * ENC361D-07A * ENC361D-10A * ENC361D-14A * ENC361D-20A *	5 7 10 14 20	230	300	7.5 15.0 35.0 65.0 120.0	0.1 0.25 0.4 0.6 1.0	250 600 1250 2500 4000	360	324	396	620 595 595 595 595	5 10 25 50 100	120 250 500 1000 2000

ENC Series Radial package



DA type: 250 – 420V AC

Ratings and characteristics table

Device type	Chip element size	Maximum ratings					Characteristics					
		Applied voltage ①		Transient			Nominal varistor ④ peak voltage		Max. clamping ⑤ voltage @ test current (8/20μs)		Typical capacitance	
		RMS 50/60Hz (25°C)	DC (25°C)	Energy ②	Average power dissipation	Peak current ③ (8/20μs)						
	Dia. [mm]	Vacm [Volts]	Vdcm [Volts]	Wtm [Joules]	Ptam [Watts]	Itm [Amps]	Vnom [Volts]	Tolerance		Vc [Volts]	Ip [Amps]	f = 1 kHz [pF]
								Min. [Volts]	Max. [Volts]			
ENC391D-05A *	5			8.0	0.1	250				675	5	110
ENC391D-07A *	7			17.0	0.25	600				650	10	220
ENC391D-10A *	10	250	320	40.0	0.4	1250	390	351	429	650	25	450
ENC391D-14A *	14			70.0	0.6	2500				650	50	900
ENC391D-20A *	20			130.0	1.0	4000				650	100	1800
ENC431D-05A *	5			9.0	0.1	250				745	5	100
ENC431D-07A *	7			20.0	0.25	600				710	10	200
ENC431D-10A *	10	275	350	45.0	0.4	1250	430	387	473	710	25	400
ENC431D-14A *	14			75.0	0.6	2500				710	50	800
ENC431D-20A *	20			140.0	1.0	4000				710	100	1600
ENC471D-05A *	5			10.0	0.1	250				810	5	80
ENC471D-07A *	7			20.0	0.25	600				775	10	170
ENC471D-10A *	10	300	385	45.0	0.4	1250	470	423	517	775	25	350
ENC471D-14A *	14			80.0	0.6	2500				775	50	700
ENC471D-20A *	20			150.0	1.0	4000				775	100	1400
ENC621D-10A *	10			45.0	0.4	1250				1025	25	270
ENC621D-14A *	14	385	505	85.0	0.6	2500	620	558	682	1025	50	550
ENC621D-20A *	20			150.0	1.0	4000				1025	100	1100
ENC681D-10A *	10			45.0	0.4	1250				1120	25	250
ENC681D-14A *	14	420	560	90.0	0.6	2500	680	612	748	1120	50	500
ENC681D-20A *	20			160.0	1.0	4000				1120	100	1000

Notes:

① The waveform of the maximum DC applied voltage is flat. When a ripple voltage as from a rectifier source is supplied make sure that the peak voltage is kept under the Vdcm.

An AC applied voltage (50/60Hz) forms a sine waveshape.

When the distortion in the waveform is extensive make sure that the peak voltage is less than $\sqrt{2}$ times the Vacm.

② Energy: Wtm

Transient energy ratings are given in the Wtm column of the specifications in Joules (watt-second).

The rating is the maximum allowable energy for a single impulse of 2ms square-waveform current with continuous voltage applied. Energy ratings are based on a shift of Vnom of less than $\pm 10\%$ of initial value.

③ Transient peak current (Itm)

The peak current rating, Itm, of varistor is based on an 8/20μs test impulse waveshape.

This peak current is the maximum peak current in which the nominal varistor voltage shift does not exceed $\pm 10\%$ when the test impulse is applied twice at 5 minutes intervals.

④ Nominal varistor voltage: Vnom

Indicates the varistor terminal voltage measured with a 1mA DC applied. — 0.1mA DC in the case of the 05A and 05B series.

⑤ Maximum clamping voltage: Vc

Indicates the peak terminal voltage measured with an 8/20μs impulse current applied.

● Operating ambient temperature: -40°C to $+85^{\circ}\text{C}$

● Storage temperature: -40°C to $+125^{\circ}\text{C}$

* UL recognized (UL 1414)

FUJI Z-TRAP varistors have been tested by Underwriter's Laboratories, Inc.

UL File No. E66188.



DA type: 460 – 1000V AC

Ratings and characteristics table

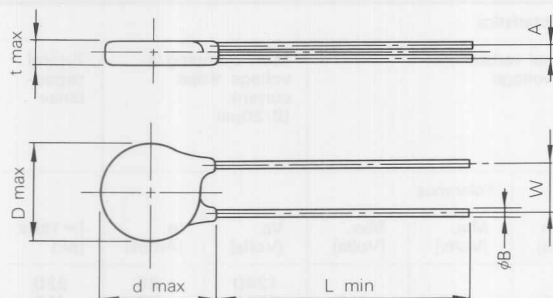
Device type	Chip element size	Maximum ratings					Characteristics					
		Applied voltage ①		Transient			Nominal varistor ④ peak voltage			Max. clamping ⑤ voltage @ test current (8/20μs)		Typical capaci- tance
		RMS 50/60Hz (25°C)	DC (25°C)	Energy ②	Average power dissipa- tion	Peak ③ current (8/20μs)						
	Dia. [mm]	Vacm [Volts]	Vdcm [Volts]	Wtm [Joules]	Ptam [Watts]	Itm [Amps]	Vnom [Volts]	Tolerance		Vc [Volts]	Ip [Amps]	f=1kHz [pF]
ENC751D-10A * ENC751D-14A * ENC751D-20A *	10 14 20	460	615	50.0 100.0 175.0	0.4 0.6 1.0	1250 2500 4000	750	675	825	1240 1240 1240	25 50 100	220 450 900
ENC781D-10A * ENC781D-14A * ENC781D-20A *	10 14 20	485	640	50.0 105.0 180.0	0.4 0.6 1.0	1250 2500 4000	780	702	858	1290 1290 1290	25 50 100	220 440 880
ENC821D-10A * ENC821D-14A * ENC821D-20A *	10 14 20	510	670	55.0 110.0 190.0	0.4 0.6 1.0	1250 2500 4000	820	738	902	1355 1355 1355	25 50 100	210 420 840
ENC911D-10A * ENC911D-14A * ENC911D-20A *	10 14 20	550	745	60.0 120.0 215.0	0.4 0.6 1.0	1250 2500 4000	910	819	1001	1500 1500 1500	25 50 100	180 380 750
ENC102D-10A * ENC102D-14A * ENC102D-20A *	10 14 20	625	825	65.0 130.0 230.0	0.4 0.6 1.0	1250 2500 4000	1000	900	1100	1650 1650 1650	25 50 100	180 350 700
ENC112D-10A * ENC112D-14A * ENC112D-20A *	10 14 20	680	895	70.0 140.0 250.0	0.4 0.6 1.0	1250 2500 4000	1100	990	1210	1815 1815 1815	25 50 100	150 300 600
ENC182D-14A * ENC182D-20A *	14 20	1000	1465	240.0 400.0	0.6 1.0	2500 4000	1800	1620	1980	2970 2970	50 100	200 400

ENC Series Radial package



DB & DA type

Dimensions, mm

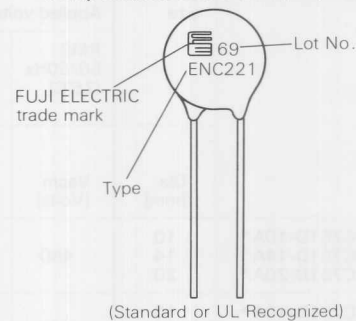
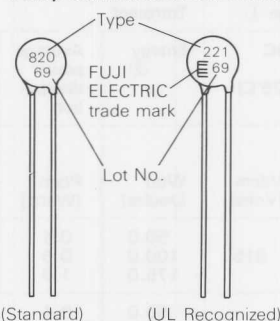


Lead wire: High temperature solder plated mild copper wire
Molded material: Flame resistant epoxy resin (UL, 94V-0 equivalent)

■ Marking

● Chip element size Dia. 5, 7mm

● Chip element size Dia. 10, 14, 20mm



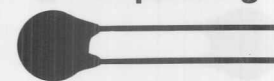
■ DB type

Type	t	A	D	d	L	W	φB	Net weight (g)
ENC180D-05B	4.5	1.7±1	7.5	10.0	35	5.0±1	0.6	0.5
ENC220D-05B	4.5	1.7±1	7.5	10.0	35	5.0±1	0.6	0.5
ENC270D-05B	4.5	1.7±1	7.5	10.0	35	5.0±1	0.6	0.5
ENC330D-05B	4.5	1.7±1	7.5	10.0	35	5.0±1	0.6	0.5
ENC390D-05B	4.5	1.7±1	7.5	10.0	35	5.0±1	0.6	0.5
ENC470D-05B	4.5	1.7±1	7.5	10.0	35	5.0±1	0.6	0.5
ENC560D-05B	4.5	1.7±1	7.5	10.0	35	5.0±1	0.6	0.5
ENC680D-05B	4.5	1.7±1	7.5	10.0	35	5.0±1	0.6	0.5
ENC180D-07B	4.5	1.7±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC220D-07B	4.5	1.7±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC270D-07B	4.5	1.7±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC330D-07B	4.5	1.7±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC390D-07B	4.5	1.7±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC470D-07B	4.5	1.7±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC560D-07B	4.5	1.7±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC680D-07B	4.5	1.7±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC180D-10B	4.6	1.6±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC220D-10B	4.7	1.9±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC270D-10B	4.8	2.2±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC330D-10B	5.0	1.6±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC390D-10B	5.0	1.8±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC470D-10B	5.0	2.0±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC560D-10B	5.0	1.7±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC680D-10B	5.3	1.9±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC180D-14B	4.6	1.6±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC220D-14B	4.7	1.9±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC270D-14B	4.8	2.2±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC330D-14B	5.0	1.6±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC390D-14B	5.0	1.8±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC470D-14B	5.0	2.0±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC560D-14B	5.0	1.7±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC680D-14B	5.3	1.9±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC180D-20B	5.1	1.9±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC220D-20B	5.2	2.1±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC270D-20B	5.3	2.4±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC330D-20B	5.5	1.8±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC390D-20B	5.5	2.0±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC470D-20B	5.6	2.2±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC560D-20B	5.7	1.9±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC680D-20B	5.8	2.1±1	23.0	27.0	30	10.0±1	1.0	3.5

■ DA type

Type	t	A	D	d	L	W	φB	Net weight (g)
ENC820D-05A	4.5	1.7±1	7.0	10.0	35	5.0±1	0.6	0.5
ENC101D-05A	4.7	1.5±1	7.0	10.0	35	5.0±1	0.6	0.5
ENC121D-05A	4.8	1.5±1	7.0	10.0	35	5.0±1	0.6	0.5
ENC151D-05A	5.0	1.5±1	7.0	10.0	35	5.0±1	0.6	0.5
ENC201D-05A	5.2	2.0±1	7.0	10.0	35	5.0±1	0.6	0.5
ENC221D-05A	5.3	2.0±1	7.0	10.0	35	5.0±1	0.6	0.5
ENC241D-05A	5.4	2.0±1	7.0	10.0	35	5.0±1	0.6	0.5
ENC271D-05A	5.6	2.2±1	7.0	10.0	35	5.0±1	0.6	0.6
ENC361D-05A	6.2	3.0±1	7.0	10.0	35	5.0±1	0.6	0.6
ENC391D-05A	6.4	3.0±1	7.0	10.0	35	5.0±1	0.6	0.6
ENC431D-05A	6.7	3.5±1	7.0	10.0	35	5.0±1	0.6	0.6
ENC471D-05A	7.0	3.5±1	7.0	10.0	35	5.0±1	0.6	0.6
ENC820D-07A	4.5	1.7±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC101D-07A	4.7	1.5±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC121D-07A	4.8	1.5±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC151D-07A	5.0	1.5±1	9.0	12.0	35	5.0±1	0.6	0.6
ENC201D-07A	5.2	2.0±1	9.0	12.0	35	5.0±1	0.6	0.7
ENC221D-07A	5.3	2.0±1	9.0	12.0	35	5.0±1	0.6	0.7
ENC241D-07A	5.4	2.0±1	9.0	12.0	35	5.0±1	0.6	0.7
ENC271D-07A	5.6	2.2±1	9.0	12.0	35	5.0±1	0.6	0.7
ENC361D-07A	6.2	3.0±1	9.0	12.0	35	5.0±1	0.6	0.8
ENC391D-07A	6.4	3.0±1	9.0	12.0	35	5.0±1	0.6	0.8
ENC431D-07A	6.7	3.5±1	9.0	12.0	35	5.0±1	0.6	1.0
ENC471D-07A	7.0	3.5±1	9.0	12.0	35	5.0±1	0.6	1.0
ENC820D-10A	5.0	2.2±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC101D-10A	5.1	1.5±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC121D-10A	5.2	1.6±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC151D-10A	5.5	1.8±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC201D-10A	5.6	2.1±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC221D-10A	5.7	2.3±1	13.5	16.5	35	7.5±1	0.8	1.5
ENC241D-10A	5.8	2.4±1	13.5	16.5	35	7.5±1	0.8	1.7
ENC271D-10A	6.1	2.6±1	13.5	16.5	35	7.5±1	0.8	1.7
ENC361D-10A	6.7	3.2±1	14.0	17.0	35	7.5±1	0.8	2.0
ENC391D-10A	6.8	3.4±1	14.0	17.0	35	7.5±1	0.8	2.2
ENC431D-10A	7.2	3.7±1	14.0	17.0	35	7.5±1	0.8	2.3
ENC471D-10A	7.5	3.9±1	14.0	17.0	35	7.5±1	0.8	2.4
ENC621D-10A	7.2	4.1±1	14.0	17.0	35	7.5±1	0.8	2.6
ENC681D-10A	7.5	4.4±1	14.0	17.0	35	7.5±1	0.8	2.8
ENC751D-10A	8.0	4.8±1	14.0	17.0	35	7.5±1	0.8	3.0
ENC781D-10A	8.2	5.0±1	14.0	17.0	35	7.5±1	0.8	3.2

ENC Series Radial package



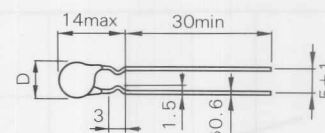
DB & DA type

■DA type

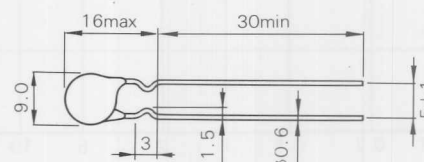
Type	t	A	D	d	L	W	φB	Net weight (g)
ENC821D-20A	8.5	5.2±1	14.0	17.0	30	7.5±1	0.8	3.2
ENC911D-20A	9.0	5.7±1	14.0	17.0	30	7.5±1	0.8	3.4
ENC102D-20A	9.5	6.2±1	14.0	17.0	30	7.5±1	0.8	3.6
ENC112D-20A	10.5	6.7±1	14.0	17.0	30	7.5±1	0.8	4.0
ENC820D-14A	5.0	2.2±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC101D-14A	5.1	1.5±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC121D-14A	5.2	1.6±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC151D-14A	5.5	1.8±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC201D-14A	5.6	2.1±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC221D-14A	5.7	2.3±1	17.0	20.0	35	7.5±1	0.8	2.5
ENC241D-14A	5.8	2.4±1	17.0	20.0	35	7.5±1	0.8	3.0
ENC271D-14A	6.1	2.6±1	17.0	20.0	35	7.5±1	0.8	3.5
ENC361D-14A	6.7	3.2±1	17.5	21.0	35	7.5±1	0.8	4.0
ENC391D-14A	6.8	3.4±1	17.5	21.0	35	7.5±1	0.8	4.0
ENC431D-14A	7.2	3.7±1	17.5	21.0	35	7.5±1	0.8	4.5
ENC471D-14A	7.5	3.9±1	17.5	21.0	35	7.5±1	0.8	4.5
ENC621D-14A	7.2	4.1±1	17.5	21.0	35	7.5±1	0.8	5.0
ENC681D-14A	7.5	4.4±1	17.5	21.0	35	7.5±1	0.8	5.5
ENC751D-14A	8.0	4.8±1	17.5	21.0	35	7.5±1	0.8	6.0
ENC781D-14A	8.2	5.0±1	17.5	21.0	35	7.5±1	0.8	6.5
ENC821D-14A	8.5	5.2±1	17.5	21.0	35	7.5±1	0.8	6.5
ENC911D-14A	9.0	5.7±1	17.5	21.0	35	7.5±1	0.8	6.5
ENC102D-14A	9.5	6.2±1	17.5	21.0	35	7.5±1	0.8	7.0
ENC112D-14A	10.5	6.7±1	17.5	21.0	35	7.5±1	0.8	7.5
ENC182D-14A	15.0	9.5±2	17.5	22.0	35	7.5±1	0.8	11.5
ENC820D-20A	5.5	2.4±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC101D-20A	5.6	1.7±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC121D-20A	5.7	1.8±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC151D-20A	5.9	2.0±1	23.0	27.0	30	10.0±1	1.0	3.5
ENC201D-20A	6.0	2.3±1	23.0	27.0	30	10.0±1	1.0	4.0
ENC221D-20A	6.2	2.5±1	23.0	27.0	30	10.0±1	1.0	4.5
ENC241D-20A	6.3	2.6±1	23.0	27.0	30	10.0±1	1.0	4.5
ENC271D-20A	6.5	2.8±1	23.0	27.0	30	10.0±1	1.0	5.0
ENC361D-20A	7.2	3.4±1	24.0	28.0	30	10.0±1	1.0	6.0
ENC391D-20A	7.4	3.6±1	24.0	28.0	30	10.0±1	1.0	6.5
ENC431D-20A	7.7	3.9±1	24.0	28.0	30	10.0±1	1.0	7.0
ENC471D-20A	8.0	4.1±1	24.0	28.0	30	10.0±1	1.0	7.5
ENC621D-20A	8.0	4.3±1	24.0	28.0	30	10.0±1	1.0	8.0
ENC681D-20A	8.2	4.6±1	24.0	28.0	30	10.0±1	1.0	9.0
ENC751D-20A	8.5	5.0±1	24.0	28.0	30	10.0±1	1.0	9.5
ENC781D-20A	8.6	5.3±1	24.0	28.0	30	10.0±1	1.0	10.0
ENC821D-20A	8.8	5.4±1	24.0	28.0	30	10.0±1	1.0	10.0
ENC911D-20A	9.3	5.9±1	24.0	28.0	30	10.0±1	1.0	11.0
ENC102D-20A	9.7	6.3±1	24.0	28.0	30	10.0±1	1.0	12.0
ENC112D-20A	10.8	6.9±1	24.0	28.0	30	10.0±1	1.0	13.0
ENC182D-20A	15.5	10.0±2	25.0	30.0	30	10.0±1	1.0	20.0

■Crimped lead type

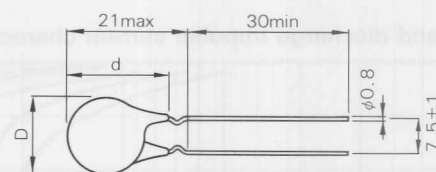
●05A, 05B



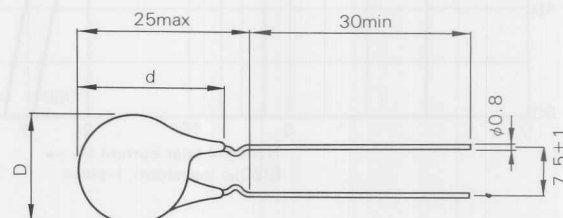
●07A, 07B



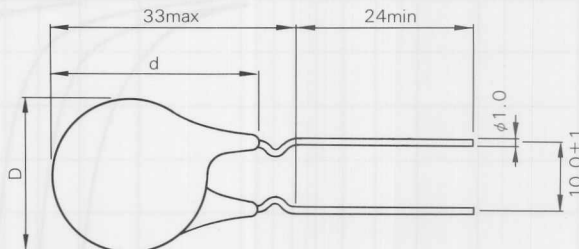
●10A, 10B



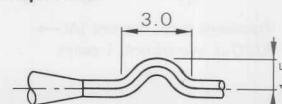
●14A, 14B



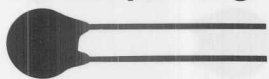
●20A, 20B



Detail crimped lead



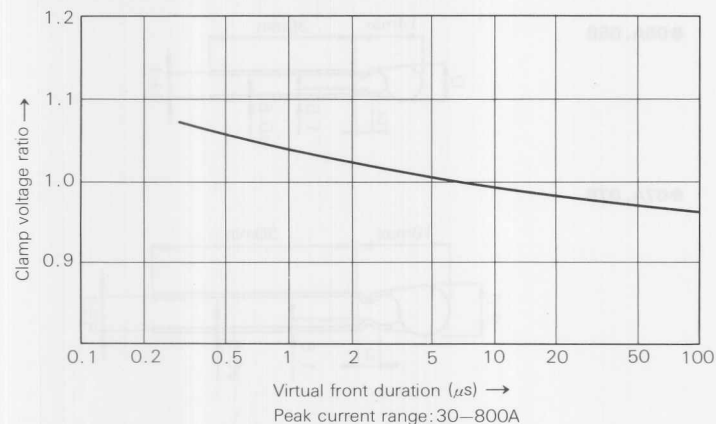
ENC Series Radial package



DB & DA type

ENC Series/Characteristic curve

● Response of current waveform

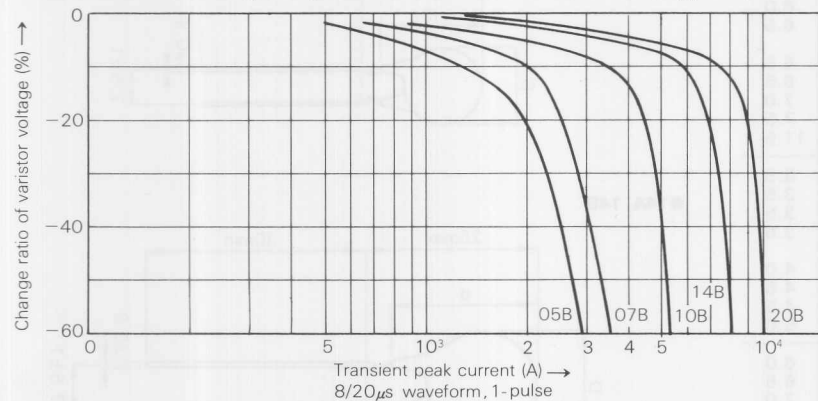


Response of current waveform

This indicates the clamping voltage characteristics based on a virtual front duration of $8\mu s$. This results in the increasing ratio of the clamping voltage which stays at approximately 10% even when a shorter current impulse in the order of 100ns is reached.

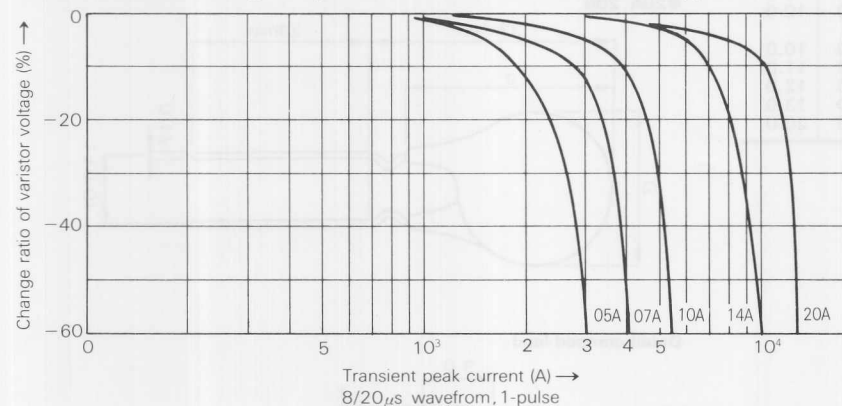
DB type

● Withstand discharge impulse current characteristics (Typical)



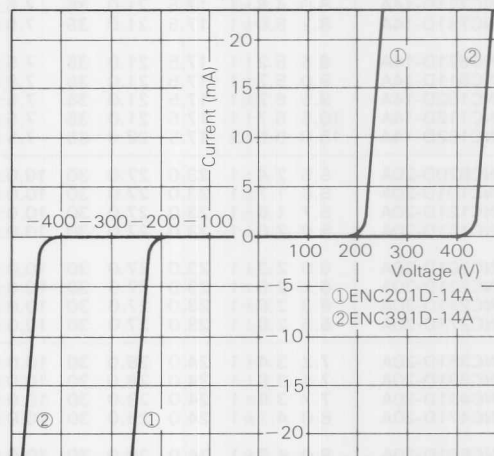
DA type

● Withstand discharge impulse current characteristics (Typical)



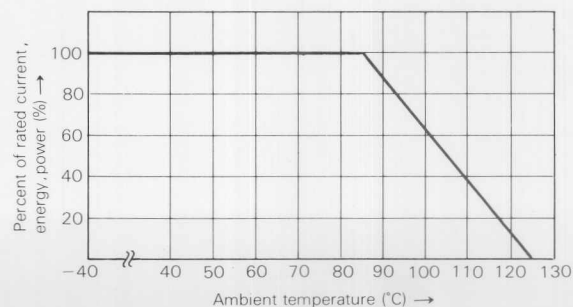
V-I curve

● Small-current region of V-I curve



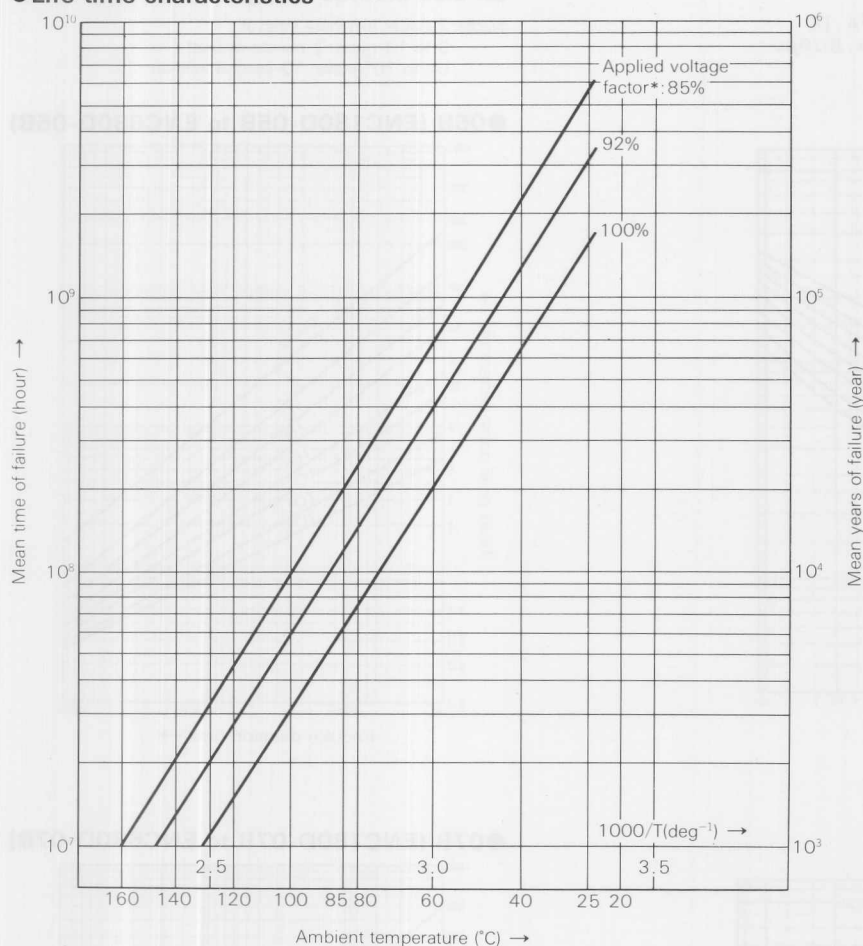
Notes: Since the V-I curve is symmetrical Z-TRAPs are capable of absorbing surges having both positive and negative polarities with a similar suppression performance.

● Current, power and energy rating vs. temperature





Life time characteristics

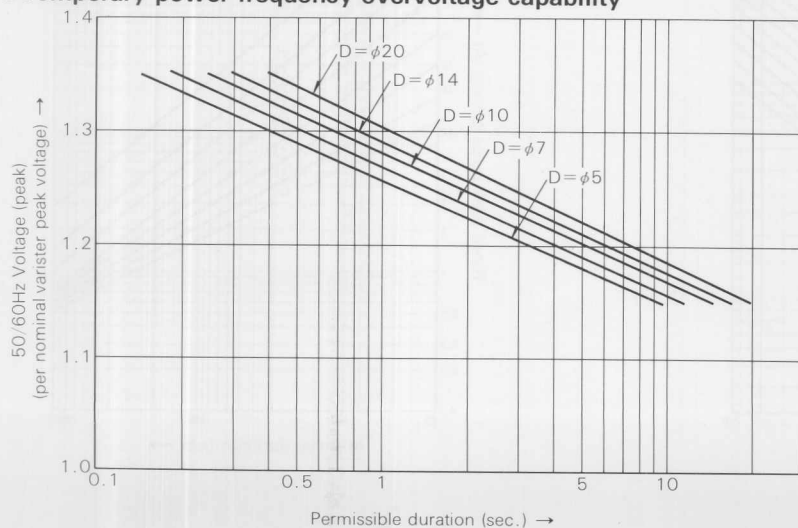


Device type: ENC201D-14A

Applied voltage: AC

*: Applied voltage factor = $\frac{\text{Applied voltage} \times \sqrt{2}}{\text{Nominal varistor voltage}}$

Temporary power frequency overvoltage capability



D : Chip element size (Dia.) (mm)

ENC Series
Radial package

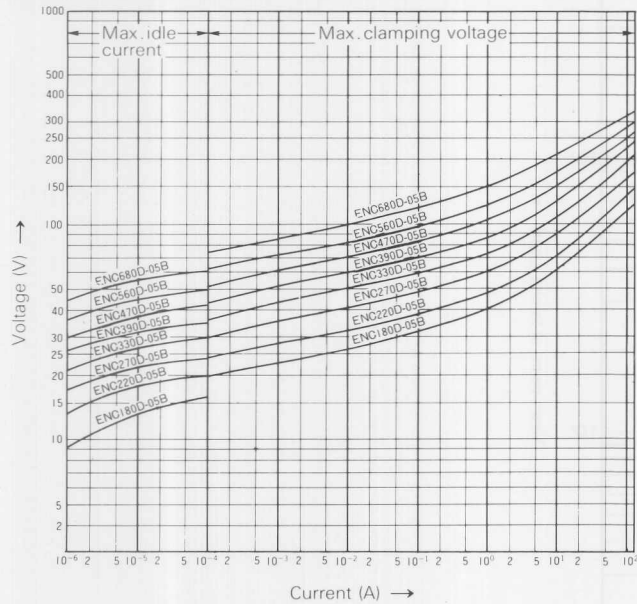


DB type

Transient V-I characteristic curves

Current waveform Under 10^{-2} A : DC
Over 10^{-1} A : 8/20 μ s

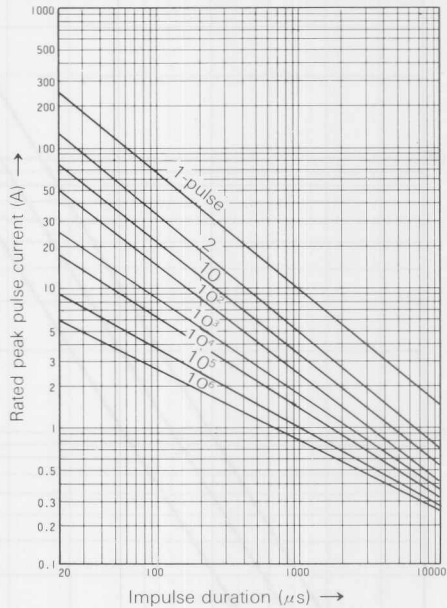
05B (ENC180D-05B to ENC680D-05B)



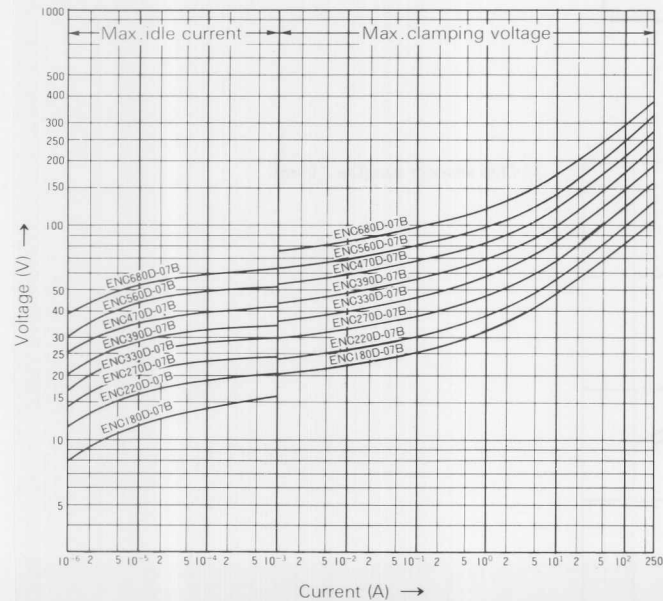
Pulse lifetime ratings

Notes: 2-pulse: 5-minute interval
3 to 10-pulse: 2-minute interval
Up to 10^6 -pulse: 10-second interval

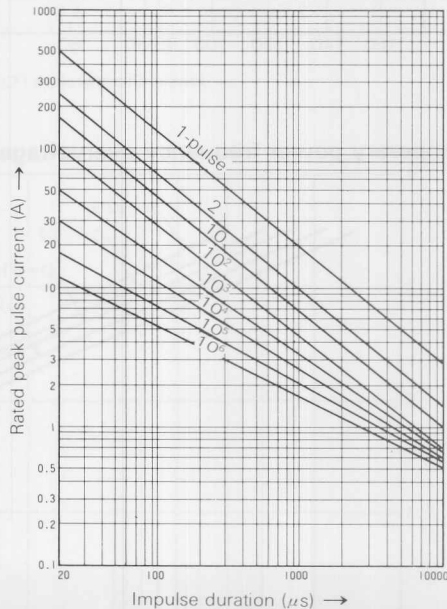
05B (ENC180D-05B to ENC680D-05B)



07B (ENC180D-07B to ENC680D-07B)



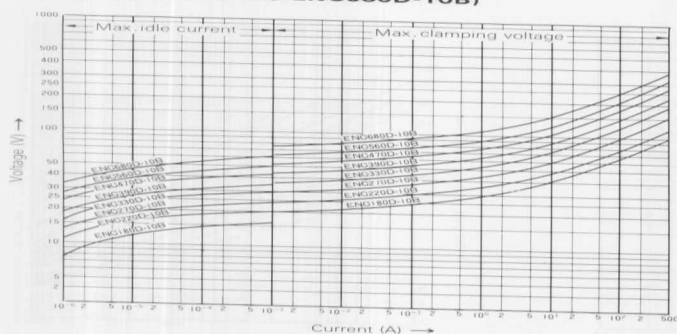
07B (ENC180D-07B to ENC680D-07B)



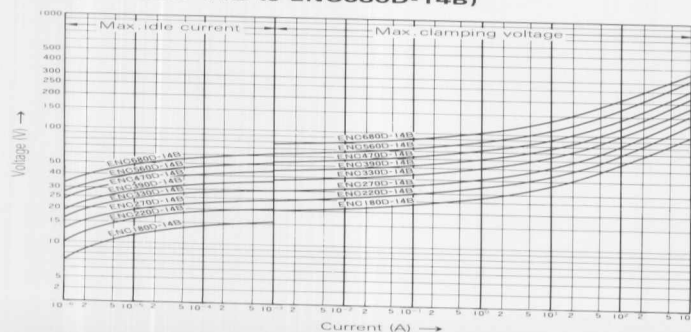
■ Transient V-I characteristic curves

Current waveform Under 10^{-2} A : DC
Over 10^{-1} A : $8/20\mu s$

● 10B (ENC180D-10B to ENC680D-10B)



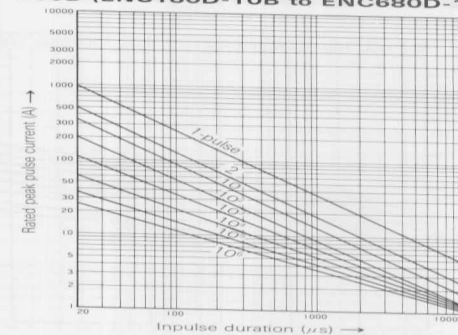
● 14B (ENC180D-14B to ENC680D-14B)



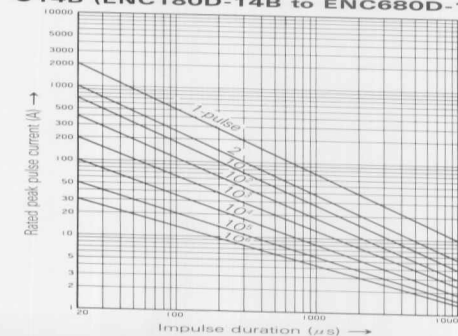
■ Pulse lifetime ratings

Notes: 2-pulse: 5-minute interval
3 to 10-pulse: 2-minute interval
Up to 10^6 -pulse: 10-second interval

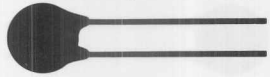
● 10B (ENC180D-10B to ENC680D-10B)



● 14B (ENC180D-14B to ENC680D-14B)



ENC Series
Radial package

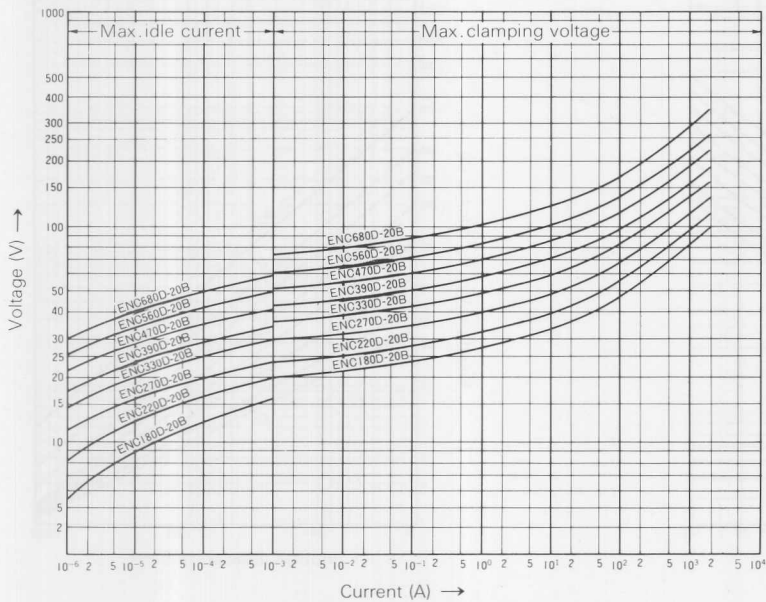


DB type

Transient V-I characteristic curves

Current waveform Under 10^{-2} A : DC
Over 10^{-1} A : $8/20\mu s$

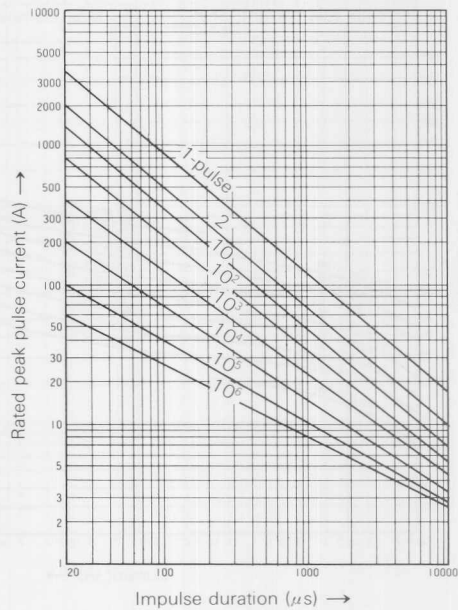
20B (ENC180-20B to ENC680D-20B)



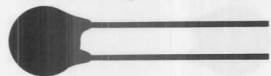
Pulse lifetime ratings

Notes: 2-pulse: 5-minute interval
3 to 10-pulse: 2-minute interval
Up to 10^6 -pulse: 10-second interval

20B (ENC180D-20B to ENC680D-20B)



ENC Series
Radial package

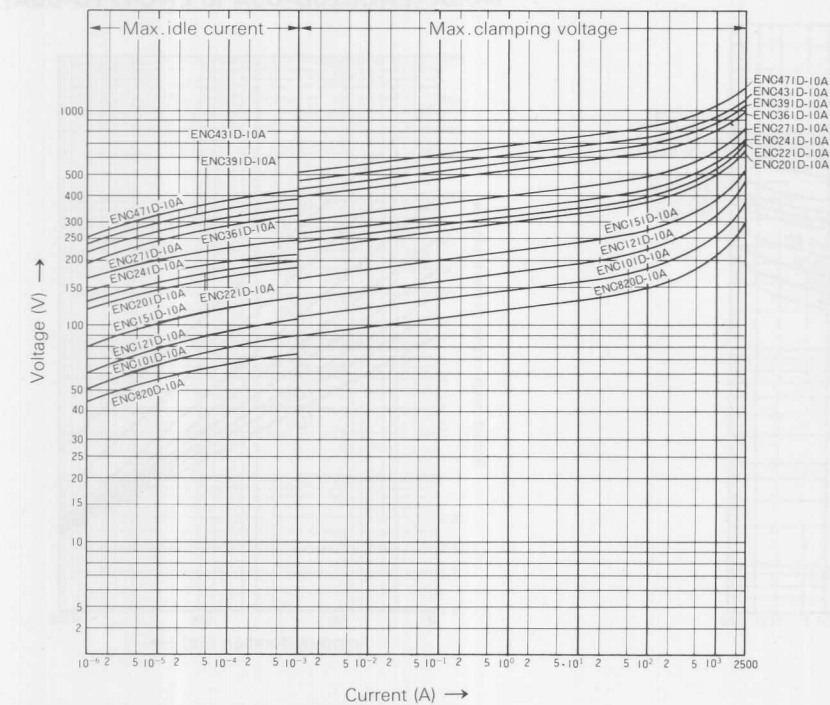


DA type

Transient V-I characteristic curves

Current waveform Under 10^{-2} A : DC
Over 10^{-1} A : 8/20 μ s

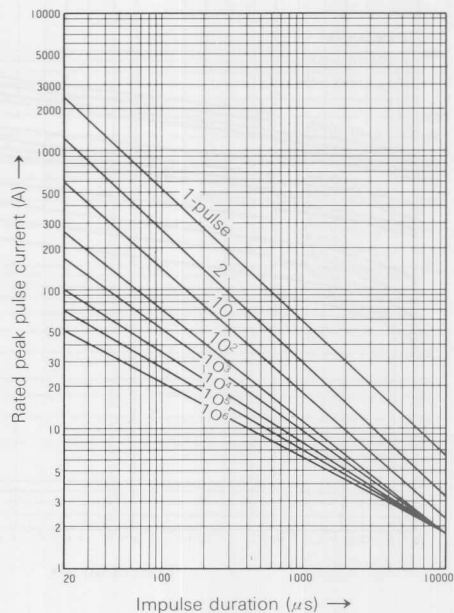
10A (ENC820D-10A to ENC471D-10A)



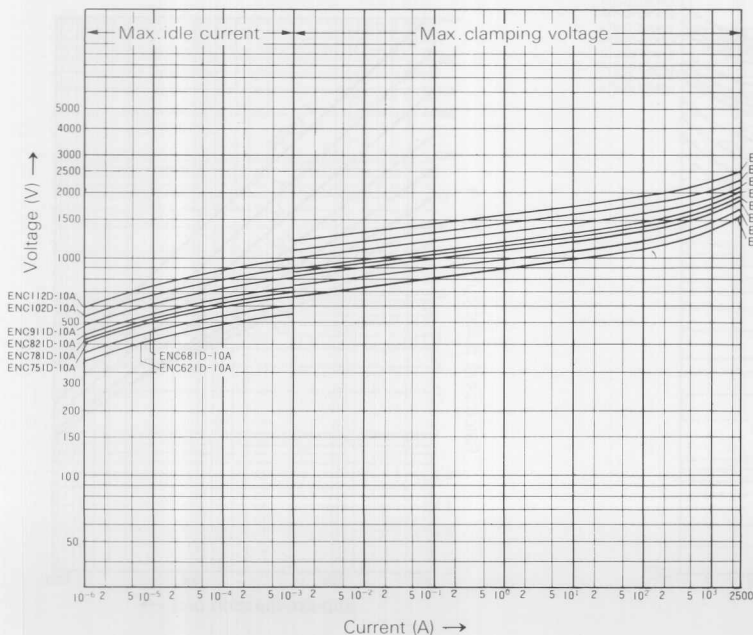
Pulse lifetime ratings

Notes: 2-pulse: 5-minute interval
3 to 10-pulse: 2-minute interval
Up to 10^6 -pulse: 10-second interval

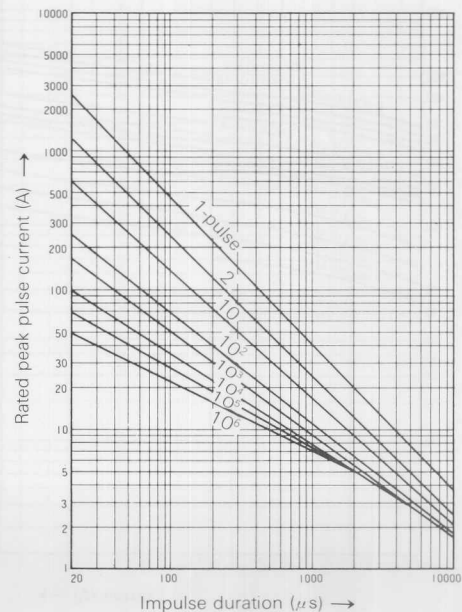
10A (ENC820D-10A to ENC471D-10A)



10A (ENC621D-10A to ENC112D-10A)



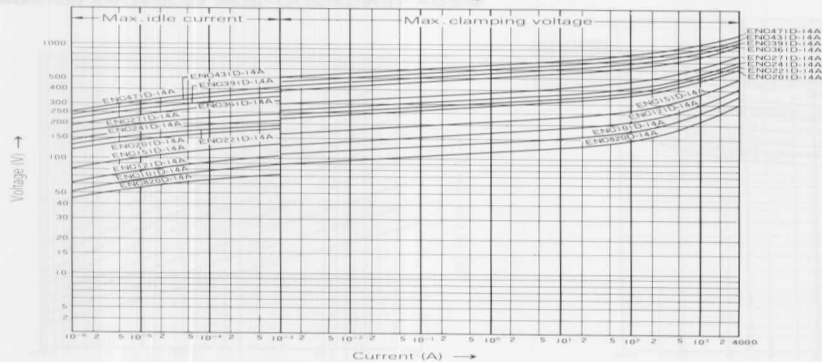
10A (ENC621D-10A to ENC112D-10A)



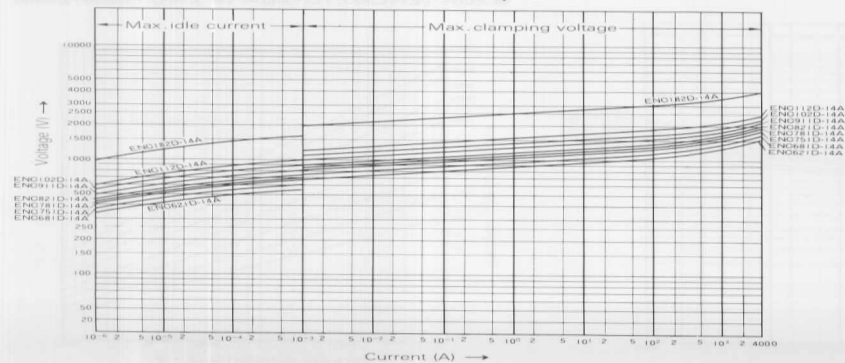
Transient V-I characteristic curves

Current waveform Under 10^{-2} A : DC
Over 10^{-1} A : $8/20\mu$ s

14A (ENC820D-14A to ENC471D-14A)



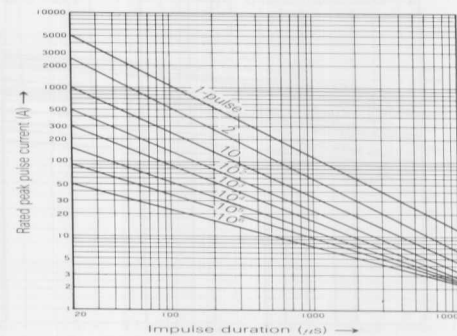
14A (ENC621D-14A to ENC182D-14A)



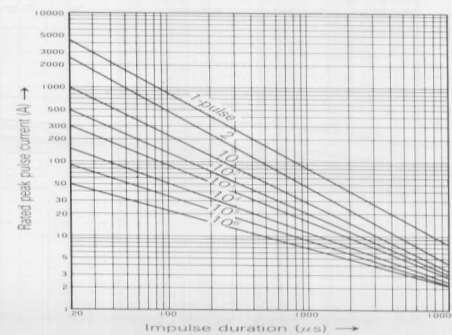
Pulse lifetime ratings

Notes: 2-pulse: 5-minute interval
3 to 10-pulse: 2-minute interval
Up to 100-pulse: 10-second interval

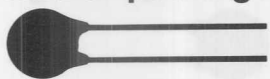
14A (ENC820D-14A to ENC471D-14A)



14A (ENC621D-14A to ENC182D-14A)



ENC Series Radial package

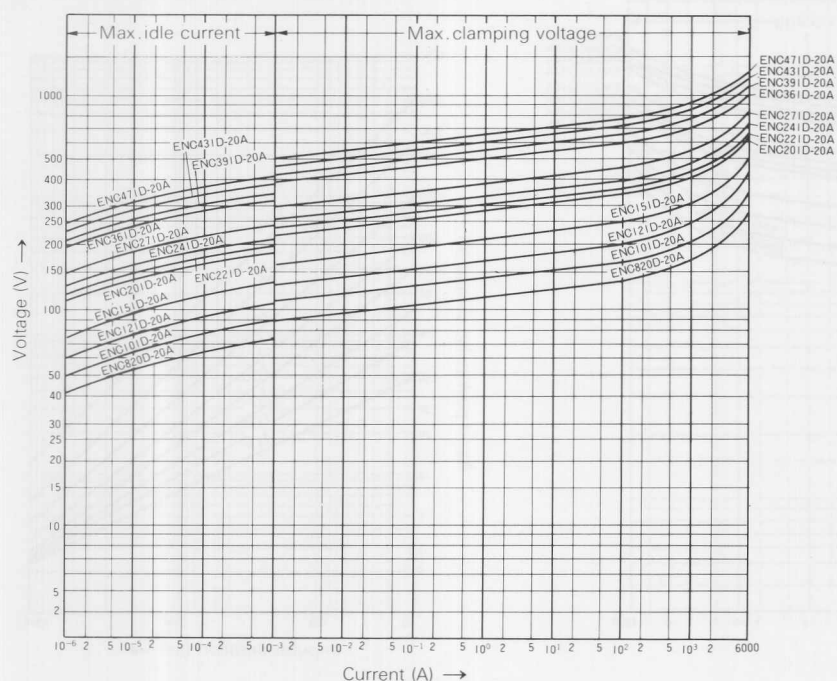


DA type

■ Transient V-I characteristic curves

Current waveform Under 10^{-2} A : DC
Over 10^{-1} A : $8/20\mu s$

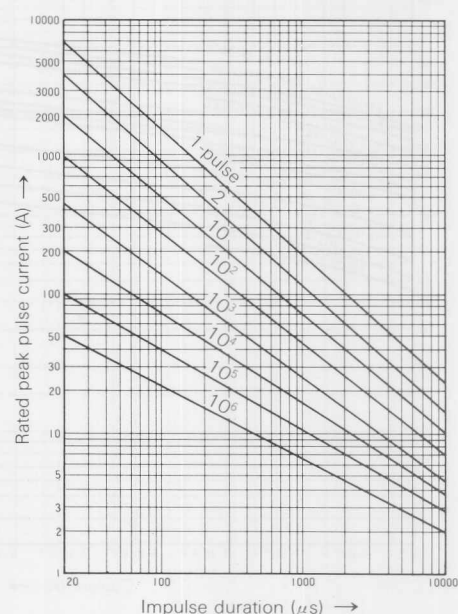
● 20A (ENC820D-20A to ENC471D-20A)



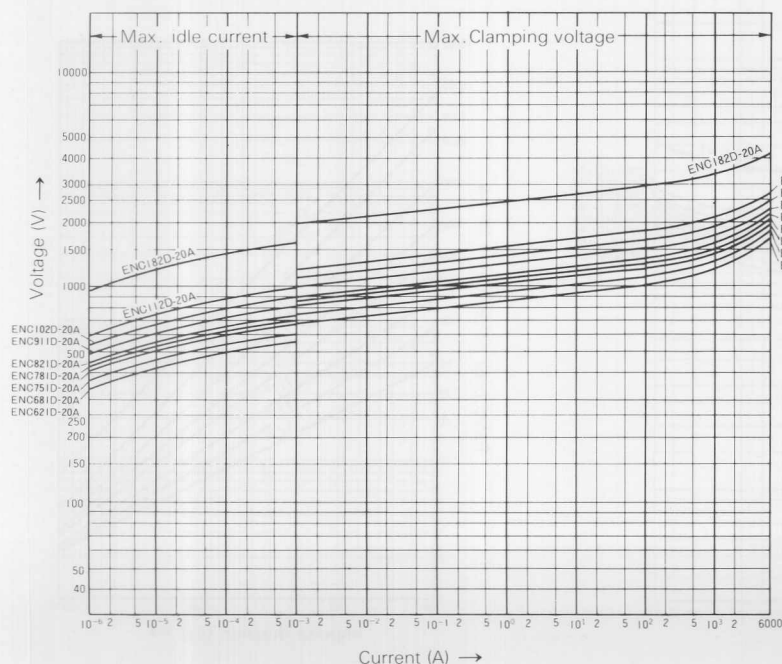
■ Pulse lifetime ratings

Notes: 2-pulse: 5-minute interval
3 to 10-pulse: 2-minute interval
Up to 10^6 -pulse: 10-second interval

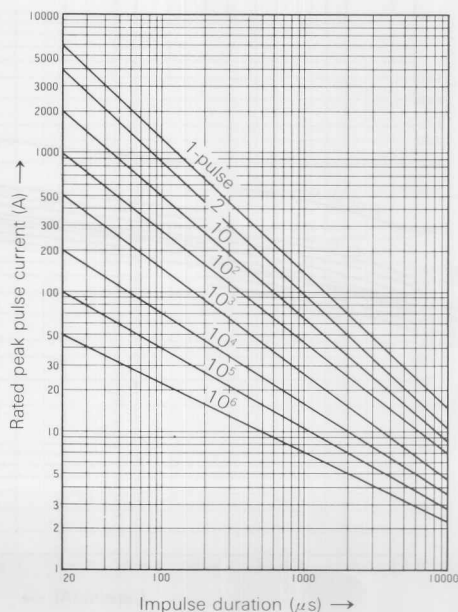
● 20A (ENC820D-20A to ENC471D-20A)



● 20A (ENC621D-20A to ENC182D-20A)



● 20A (ENC621D-20A to ENC182D-20A)



Ratings and characteristics table

Specifications

Device type	Maximum ratings					Characteristics		
	Applied voltage ①		Transient			Varistor peak voltage *: 1.0mA DC **: 0.1mA DC	Max. clamping voltage @ test current 10mA DC ⑤	Typical capacitance
	RMS 50/60Hz (25°C)	DC (25°C)	Energy ②	Average power dissipation	Peak current (8/20μs) ③			
	Vacm [Volts]	Vdcm [Volts]	Wtm [Joules]	Ptam [Watts]	I _{tm} [Amps]	Vnom [Volts] ④	Vc [Volts]	f=1kHz [pF]
ENC270M-03B	17	17	0.22	0.01	25	24— 33 *	40	410
ENC330M-03B	21	21	0.26			30— 40 *	50	370
ENC390M-03B	25	25	0.31			35— 47 *	60	300
ENC470M-03B	30	32	0.38			42— 55 *	68	260
ENC560M-03B	35	40	0.45			50— 65 *	75	230
ENC680M-03B	43	48	0.54			61— 78 *	85	220
ENC820M-03A	52	58	0.66	0.05	100	73— 93 **	120	200
ENC101M-03A	63	84	1.00			93—115 **	150	150
ENC251M-03A	156	210	2.00			233—288 **	375	60
ENC461M-03A	286	380	4.00			422—530 **	690	40

Notes:

① The waveform of the maximum DC applied voltage is flat. When a ripple voltage as from a rectifier source is supplied make sure that the peak voltage is kept under the Vdcm.

An AC applied voltage (50/60Hz) forms a sine waveform.

If the waveform is badly distorted make sure that the peak voltage is less than $\sqrt{2}$ times the Vacm.

② Energy: Wtm

Transient energy ratings are given in the Wtm column of the specification in Joules (watt-second).

The rating is the maximum allowable energy for a single impulse of 2ms square-waveform current continuously applied.

Energy ratings are based on a shift of Vnom of less than $\pm 10\%$ of the initial value.

③ Transient peak current: I_{tm}

The peak current rating, I_{tm}, of the varistor is based on an 8/20μs test impulse waveform. This peak current is the maximum peak current in which the nominal varistor voltage shift does not exceed $\pm 10\%$ when the test impulse is applied twice at 5 minute intervals.

④ Nominal varistor voltage: Vnom

Indicates the varistor terminal voltage with 1mA DC applied in case of ENC270M-03B to ENC680M-03B, and with 0.1mA DC applied in case of ENC820M-03A to ENC461M-03A.

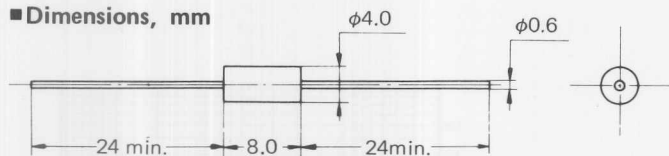
⑤ Maximum clamping voltage: Vc

This is the peak terminal voltage with an applied 10mA DC rectangle impulse current with 3ms.

● Operating ambient temperature: -40°C to +85°C

● Storage temperature: -40°C to +100°C

Dimensions, mm

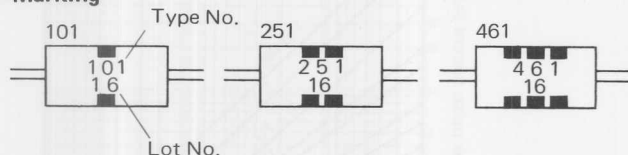


Lead wire : Silver-clad copper wire

Molded material : Flame resistant epoxy resin (UL 94V-0 equivalent)

Net weight : Max. 0.5g

Marking



Type number nomenclature: See page 2

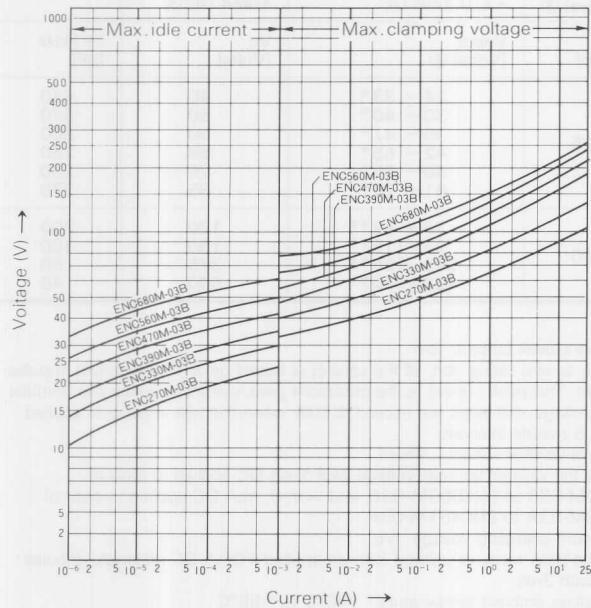
ENC Series
Axial package

MB & MA type

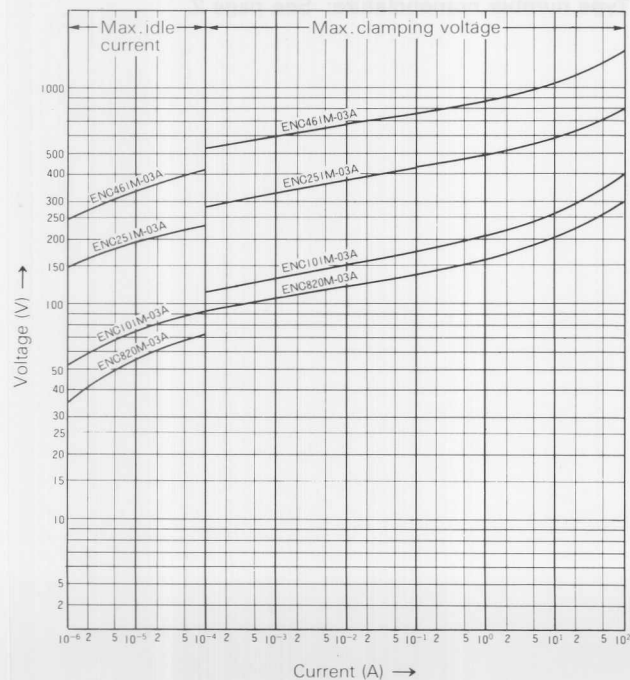
Transient V-I characteristic curves

Current waveform Under 10^{-2} A : DC
Over 10^{-1} A : 8/20 μ s

03B (ENC270M-03B to ENC680M-03B)



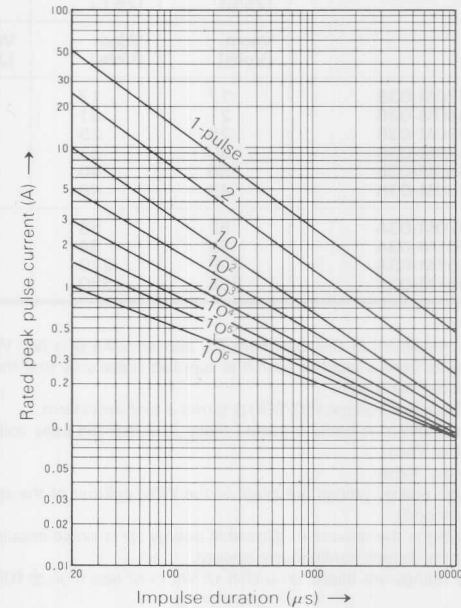
03A (ENC820M-03A to ENC461M-03A)



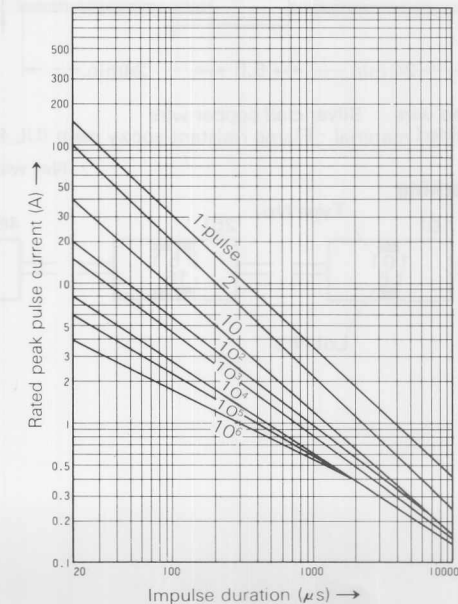
Pulse lifetime ratings

Notes: 2-pulse: 5-minute interval
3 to 10-pulse: 2-minute interval
Up to 10^6 -pulse: 10-second interval

03B (ENC270M-03B to ENC680M-03B)



03A (ENC820M-03A to ENC461M-03A)

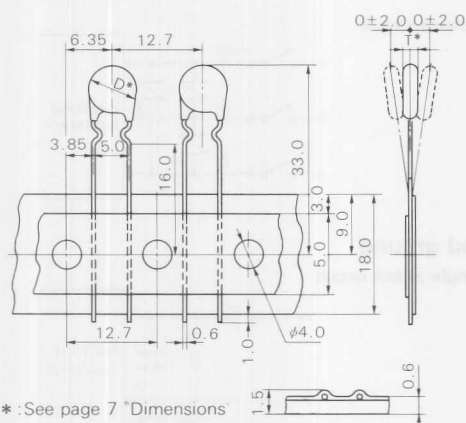


Radial and Axial Tapes, Reels

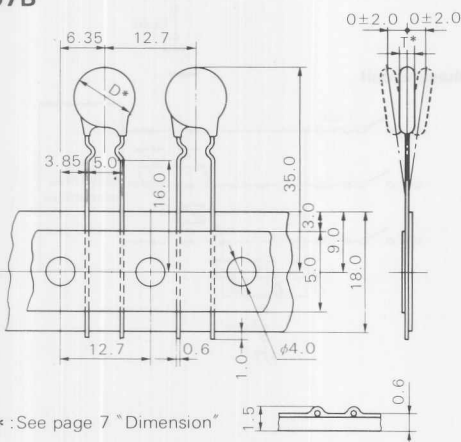
Radial tape and reel (Axial tape and reel) dimensions conform to EIAJ Standards. The nominal values of the dimensions are as shown in the drawings.

Standards: EIAJ RC-1008 (ANSI/EAIRS-468) (ANSI/EAIRS-296)

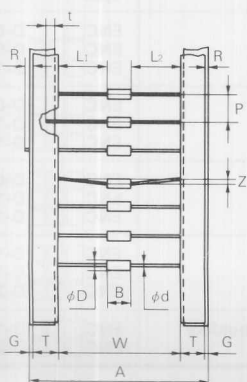
Radial package ●05A, 05B



●07A, 07B



Axial package



Mark	Dimensions, mm
W	51-54
P	5.0 ± 0.5
L1-L2	1.0
T	6.0 ± 0.5
Z	1.2
R	0
t	3.2
A	68.0
G	0.5
B	8
ϕD	4
ϕd	0.6

Packing

The packing for the radial type varistors is available in "Tape and Reel" or "Tape and Box (winding)". When requiring "Radial Tape and Reel" add "T" to the end of the type letter. When requiring "Radial Tape and Box" add "T-B (winding)". The packing for the Axial type varistors is available in "Tape and Reel". In this case add "T" to the end of the type letter.

Radial package tape and reel, tape and box

ENC220D-05B-T-B

Z-Trap type

- ENC180D-05B to ENC680D-05B
- ENC8200-05A to ENC471D-05A
- ENC180D-07B to ENC680D-07B
- ENC820D-07A to ENC471D-07A

T: Taping

Packing

No mark: Reel packing

B : Box packing

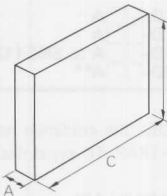
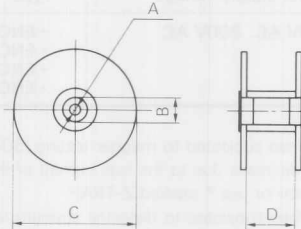



Axial package tape and reel

ENC270M-03B-T

Z-Trap type

- ENC270M-03B to ENC680M-03B
- ENC820M-03A to ENC461M-03A

T: Taping

Packing	Box packing	Reel packing	
			
Dimensions, mm	Radial package	Radial package	Axial package
			
A	55	A	$\phi 28$
B	250	B	$\phi 75$
C	320	C	350
—	—	D	80
Quantity	1000 pieces/box	1000 pieces/reel	4000 pieces/reel

- The protection of semiconductor elements such as diodes, thyristors, transistors, IC and relays against transient voltages.
- Similar protection of many types of measuring instruments, control machinery and equipment, communication and broadcasting equipment against inductive lightning and switching surges.
- Protection of general purpose electrical equipment, domestic machinery and appliances, TV and radios and similar consumer products against lightning and switching surges.

Power supply circuit protection

Line circuit

Varistor voltage selection table (Z_L)

Power supply voltage	Type
100V AC	ENC201D-□□A ENC221D-□□A ENC241D-□□A ENC271D-□□A*
200V AC	ENC391D-□□A ENC431D-□□A ENC471D-□□A*
12V DC	ENC220D-□□B
48V DC	ENC390D-□□B

Notes:

- ① The power supply voltage must not exceed the maximum allowable circuit voltage.
- ② Since independent wiring loads and capacitive loads cause the voltage build-up at the time of opening or closing the load, use Z-trap having a varistor voltage as high as possible. (*mark)
- ③ The bold faced portions of the type letters vary.

Line and ground circuit

Varistor voltage selection table (Z_E)

Power supply voltage	Type
100V AC, 200V AC	• ENC431D-□□A • ENC471D-□□A • ENC751D-□□A to ENC112D-□□A* • ENC182D-□□A**

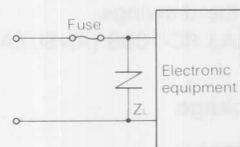
Notes:

- ① When subjected to megger testing (500V DC), the insulation resistance value can decrease due to the leak current of the Z-TRAP. To avoid this, remove the varistor or use * marked Z-TRAP.
- ② When subjected to dielectric strength test (1000V AC), remove the Z-TRAP or use ** marked Z-TRAP.

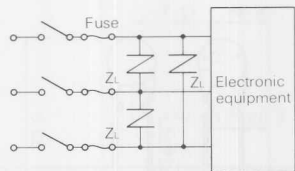
Select varistors taking a note of operating conditions peculiar to the equipment.

Line circuit

AC/DC single-phase circuit

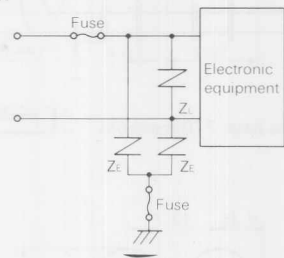


AC three-phase circuit

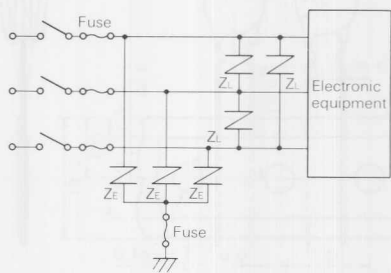


Line and ground

AC/DC single-phase circuit



AC three-phase circuit



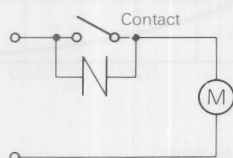
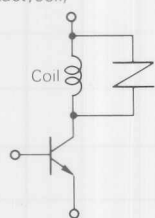
Pulse energy selection table (Z_L)

Use	Location	Type
Consumer products	Indoor	ENC□□□ D-05A, 05B ENC□□□ D-07A, 07B ENC□□□ D-10A, 10B
	Outdoor	ENC□□□ D-07A, 07B ENC□□□ D-10A, 10B ENC□□□ D-14A, 14B
Communication, instrumentation, general	Indoor	ENC□□□ D-07A, 07B ENC□□□ D-10A, 10B ENC□□□ D-14A, 14B
	Outdoor	ENC□□□ D-10A, 10B ENC□□□ D-14A, 14B ENC□□□ D-20A, 20B
General industrial power supply	Indoor or outdoor	ENC□□□ D-14A, 14B ENC□□□ D-20A, 20B

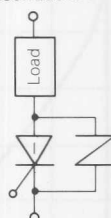
Note: The bold faced portions of the type letters vary.

Switching circuit protection

Protection of relay
(Contact, coil)



Protection of
semiconductors



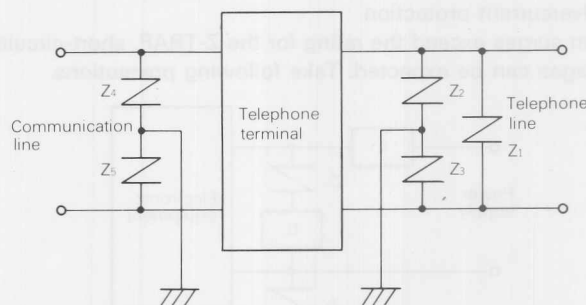
Varistor voltage selection guide

Power supply voltage	Type
12V DC	ENC220D-□□B
24V DC	ENC390D-□□B
100V DC	ENC151D-□□B
100V AC	ENC201D-□□A ENC221D-□□A ENC241D-□□A ENC271D-□□A

Notes:

- ① The power supply voltage must not exceed the maximum allowable circuit voltage of the Z-TRAP.
- ② Pay due attention to the surge energy generated by the load.
- ③ Select Z-TRAP referring to the pulse lifetime rating.
- ④ To further reduce the tendency of sparking across the contacts connect a capacitor in parallel with the Z-TRAP. This will also protect the equipment from electromagnetic wave-jamming.

Telecommunication circuit protection



Varistor voltage selection guide

Power supply voltage	Type
12V DC	• ENC180D-□□B • ENC220D-□□B • ENC820D-□□A to ENC182D-□□A
24V DC	• ENC390D-□□B • ENC820D-□□A to ENC182D-□□A

Note:

The Z-TRAP has a capacitance value. Take note of this when applying them to high-frequency signal circuits.

Applications

- Overvoltage protection for semiconductors
Diodes, thyristors, transistors and IC's
- Overvoltage protection for relays, contacts and coils
- Induced transients (lightning) and switching-surge protection
Measuring instruments, control equipment and communication, broadcasting equipment and similar equipment
- Induced transients (lightning) and switching-surge protection
Consumer equipment such as domestic and acoustic equipment
- Surge protection
Automobile electric equipment

Application examples

- Telephone switchboards, PBX's, telephones, telephone terminals

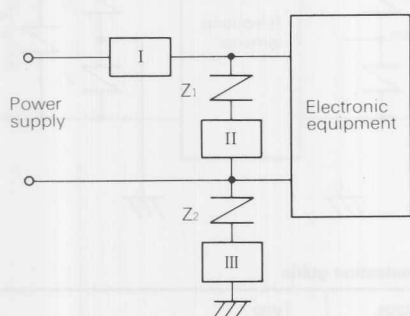
- Domestic security devices, fire alarms, signal equipment for rail and road traffic, disaster prevention shutters and pressure sensors
- NC machine tools, robots
- TV's, VTR's, audio equipment, broadcast relay equipment
- Computers, food processors, PPC copying machines, programmable controllers
- Vending machines, note validators, ECR's, POS's, medical equipment, hotel vendors
- Air conditioning equipment, heaters, refrigerators, washing machines, electronic cooking ranges, humidifiers, rice boiler jars, electric fans
- Large size kerosene stoves, boilers
- Valve operating controllers, relay control equipment, magnetic brakes and clutches, air-load break switches, ELCB's
- Semiconductor power conversion systems
motor controllers, centralized meter reading equipment
- Automobiles, automobile radios and stereos

ENC Series Applications

■ Application notes

1. Overcurrent protection

When surges exceed the rating for the Z-TRAP, short-circuits or damages can be expected. Take following precautions.



① Connect the Z-TRAP at a position nearer to the equipment than the overcurrent protection device "I" (fuse, MCCB) as is shown in the diagram.

When the Z-TRAP is shorted, the overcurrent protection device "I" operates (trips or blow off the fuse).

② If the overcurrent protection device "I" can not be installed in "I" position, connect a fuse at "II" position. Select fuse rated current for the Z-TRAP referring to the following table.

Z-Trap type	05A 05B	07A 07B	10A 10B	14A 14B	20A 20B
Applicable fuse rated current (A)	1 to 2	2 to 3	3 to 5	3 to 10	5 to 15

③ When "Z₂" Z-TRAP is connected between the equipment and ground install an ELCB (Earth Leakage Circuit Breaker). If not possible, connect a fuse or thermal fuse at "III" position.

2. Installation

① When operated at locations near heating element or exposed to direct sun light, confirm that the ambient temperature is within the rated temperature range.

② When operated in dusty or dirty locations, in exposed or corrosive atmospheres, or where metallic powders or salt can be expected, be sure to mount within a protective enclosure.

3. Molding

When shielding the Z-TRAP in a resin molding, take a note of the materials used and temperature, since they influence the reliability. For further information please contact FUJI.

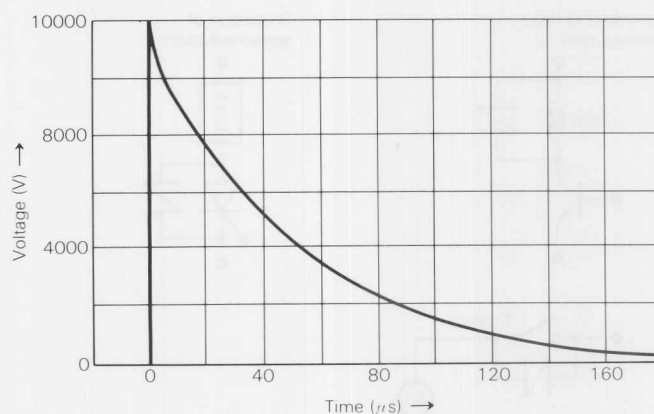
4. Megger test

When testing with a megger, allow for the leak current of the Z-TRAP, as this can influence the resistance value. To obtain accurate insulation resistance value, separate the Z-TRAP from the circuit.

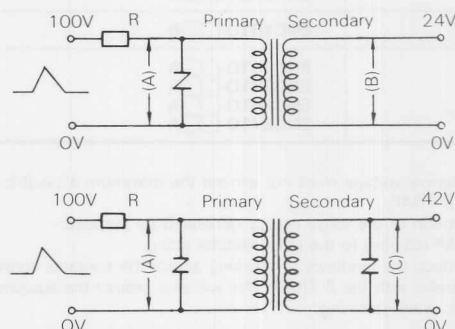
5. Applied voltage

Take care that the power supply voltage does not exceed the maximum allowable circuit voltage of varistor.

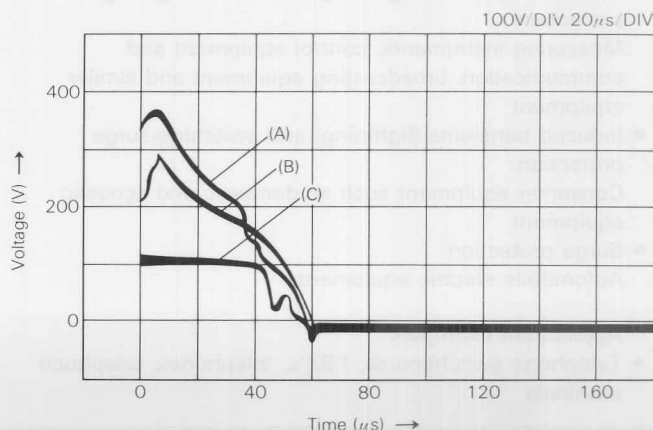
Example of lightning surge absorption effect



- Applied voltage original surge wave-from 1/40μs wave
- Peak voltage 10kV
- 2000V/DIV 20μs/DIV
- Transformer: Shell-type core construction
- Capacity: 100VA
- R: surge impedance

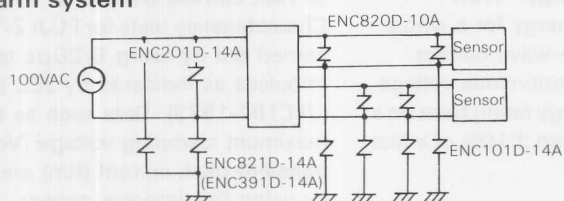


- Primary: Voltage suppression wave-from when ENC201D-14A is connected.....(A)
- Secondary: Without Z-TRAP.....(B)
- Secondary: Voltage suppression wave-form when ENC820D-14A is connected.....(C)

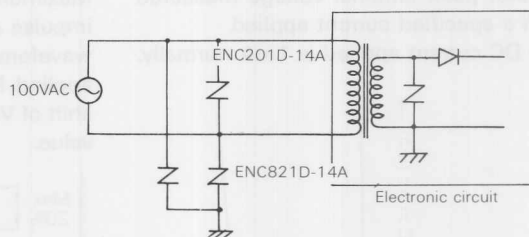


ENC Series Application Example

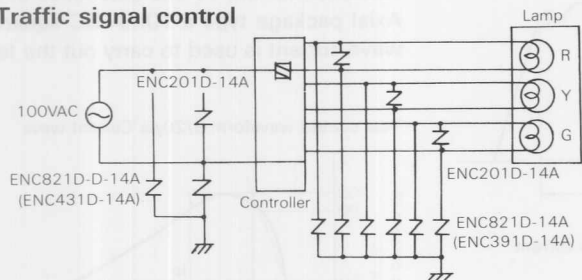
Fire alarm system



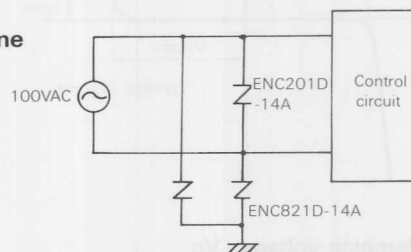
Stove, Boiler



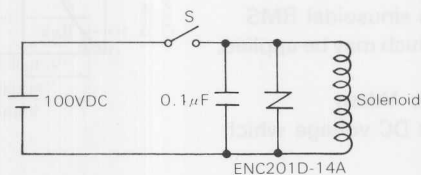
Traffic signal control



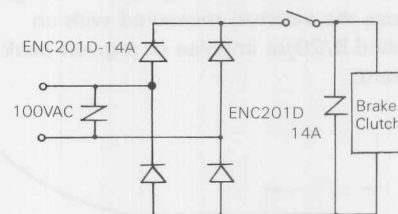
Vending machine



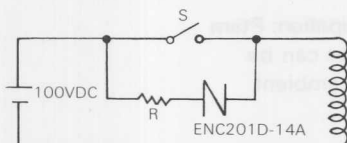
Solenoid



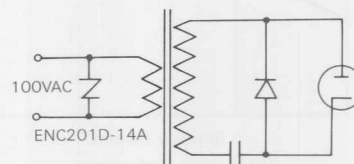
Brake, Clutch



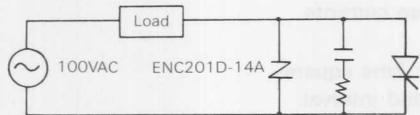
Contact protection



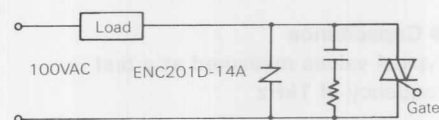
Microwave oven



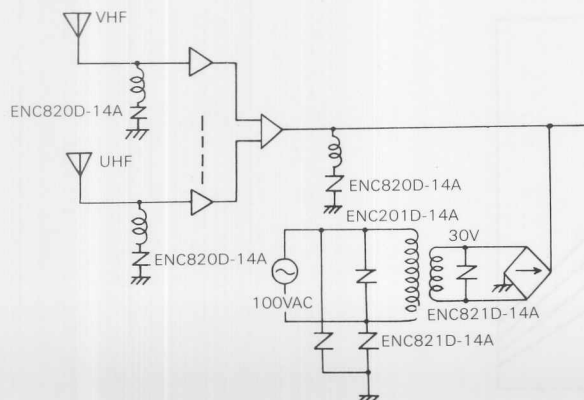
Thyristor protection



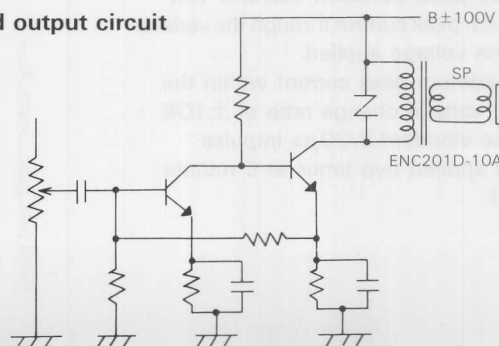
Triac protection



TV booster



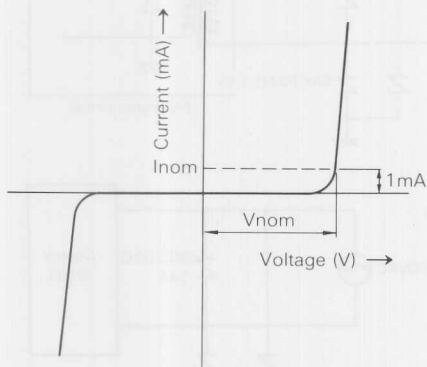
Sound output circuit



VARISTOR TERMINOLOGY

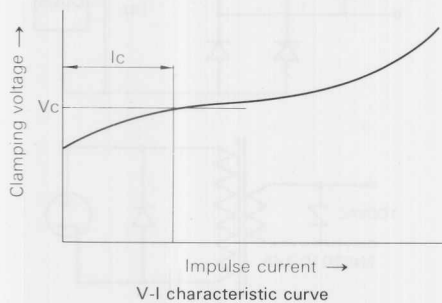
● Varistor voltage: V_{nom}

Varistor peak terminal voltage measured with a specified current applied. The DC current applied is 1mA normally.



● Clamping voltage: V_c

Maximum terminal voltage (peak voltage across the varistor) measured with an applied 8/20 μ s impulse of a given peak current.



● Capacitance

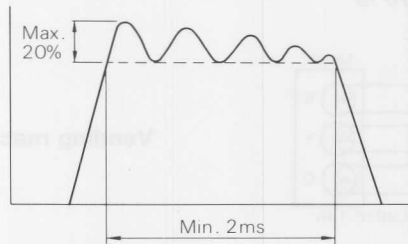
Typical values measured at a test frequency of 1 kHz

● Rated peak transient current: I_{tm}

Maximum peak current through the varistor with line voltage applied. The maximum peak current within the varistor voltage change ratio of $\pm 10\%$ with the standard 8/20 μ s impulse current applied two times at 5 minute interval.

● Rated transient energy: W_{tm}

Maximum allowable energy for a single impulse of 2ms square-wave current waveform with rated continuous voltage applied. Maximum energy rating base on a shift of V_{nom} of less than $\pm 10\%$ of initial value.



Waveshape of square-wave current

● Rated RMS voltage: V_{acm}

Maximum continuous sinusoidal RMS voltage at 50/60Hz which may be applied.

● Rated DC Voltage: V_{dcm}

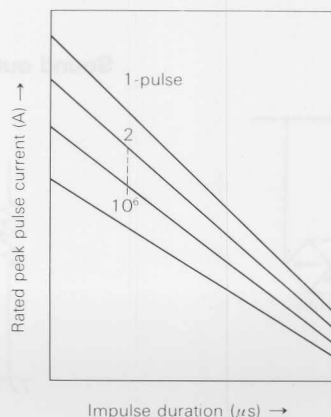
Maximum continuous DC voltage which may be applied.

● Rated average power dissipation: P_{tam}

Maximum average power that can be applied within the specified ambient temperature.

● Pulse lifetime rating

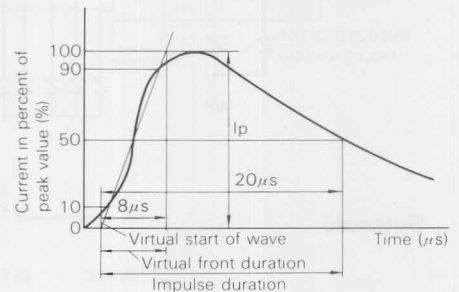
This is expressed as the maximum allowable number of impulse currents applied. 8/20 μ s impulse current (or 2ms square-wave) is applied at prescribed interval. This curve also provides for derating current as required with repetitive pulsing.



● Test current waveform

Characteristics tests for FUJI Z-TRAPs are carried out by using 8/20 μ s test impulses as indicated by JEC Standards (JEC187-1973). Data such as the maximum clamping voltage (V_c) and the transient peak current (I_{tm}) are obtained by using this impulse current. However, for the V_c characteristics of the Axial package type a 10mA DC square-wave current is used to carry out the test.

Test current waveform 8/20 μ s Current wave



New ENC Series Varistor chips

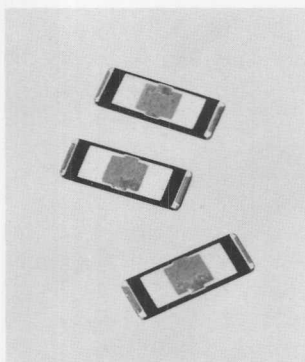


LA & AA type

SURFACE-MOUNT, DUAL PACKAGE, LA Type

As shown in the circuit diagram, these types comprise a package which incorporates two metal oxide varistors. They are leadless, a space-saving feature and can be directly mounted on printed circuit board surfaces. These types have ratings almost similar to that of the ENC121D-07A.

LA type Z-TRAP's having other ratings than this are also available on request.



■ Applications

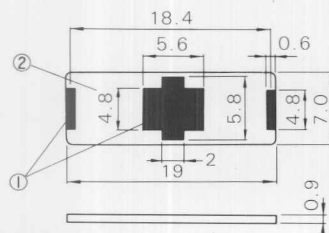
These types are used as security devices on the primary side of digital telephone switchboards.

•Type: ENC121L-09A2

■ Characteristics

Items	Characteristics
Max. applied voltage	AC: 117.4VP (Ringing signal) DC: 108V
Energy	7Joules (Test current: 10/1000 μ s, 10-pulse)
Transient peak current	25A (Test current: 10/1000 μ s, 10-pulse)
Nominal varistor peak voltage	124 to 136V at 1mA DC
Max. clamping voltage	$\leq 200V$ (Test current: 8/20 μ s, $I_p=15A$)
Capacitance	$\leq 1350PF$ ($f=1kHz$ to 1MHz, $V_b=0V$)
Dielectric loss tangent	0.1 or less ($f=1kHz$ to 1MHz, $V_b=0V$)
Voltage temperature coefficient	$-0.05\%/^{\circ}C$ (at 25 to 85 $^{\circ}C$)
Operating ambient temperature	-40 to +85 $^{\circ}C$
Storage temperature	-40 to +100 $^{\circ}C$

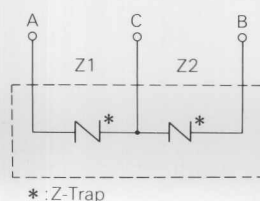
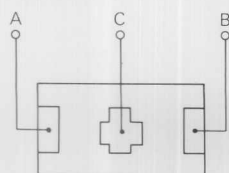
■ Dimensions, mm



■ Materials

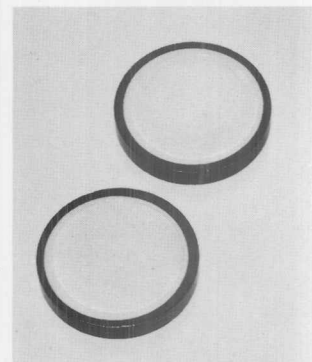
Parts	Materials
① Terminals	Silver (Ag)
② Surface	Glass coating

■ Circuit



DISK CHIPS, AA Type

This is the disk element for the FUJI Z-TRAP. The impulse withstanding strength is as high as 40kA (4/10 μ s) with a maximum energy capability of 600 Joules.



■ Applications

This type is highly suitable for transient current protection for low voltage circuit arrestors, motor control circuits and VCB power supply circuits.

•Type: ENC112A-32A

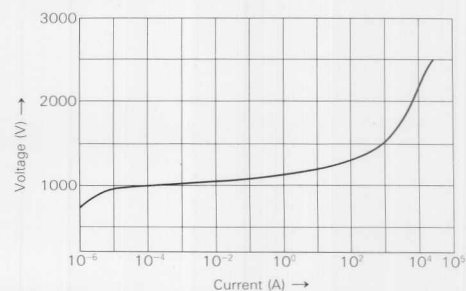
Note:

When resin molding, influence to the characteristics due to the materials or the temperature can be expected. For details please contact FUJI.

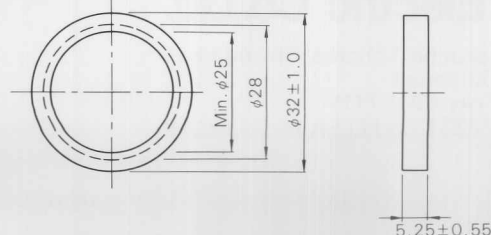
■ Characteristics

Items	Characteristics
Max. applied voltage	600V AC
Energy	600 Joules
Transient peak current	40kA (Test current: 4/10 μ s)
Nominal varistor peak voltage	1050V at 1mA DC
Max. clamping voltage	2300V at 2500A
Voltage temperature coefficient	$-0.1\%/^{\circ}C$
Nominal discharge current	2500A (Test current: 8/20 μ s)
Long duration discharge current	75A at 2ms
Operating ambient temperature	-20 to +40 $^{\circ}C$
Storage temperature	-20 to +75 $^{\circ}C$

■ Characteristic curve



■ Dimensions, mm



FUJI Ceramic Surge Absorbers

New ENC Series

Z-TRAP for Transient Voltage Protection

Fuji Electric Co., Ltd.

12-1 Yurakucho 1-chome, Chiyoda-ku,
Tokyo, 100 Japan
Phone: Tokyo 211-7111
Telex: J22331 FUJIELEA or FUJIELEB



**South
Continental
Devices (Pty) Ltd**

Electronic Components Instrumentation and Computer Systems

5th Floor, Randover House, Dover Street
Randburg, South Africa
P.O. Box 56420, Pinegowrie 2123, South Africa

☎ (011) 789-2400 **TX** 4-24849 SA FAX 7870831 GpIII